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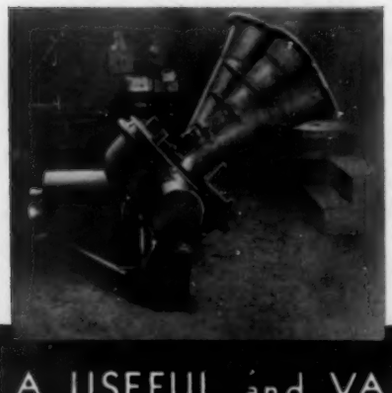

A USEFUL and VALUABLE TOOL IN ANY WELDING SHOP

VOL. 24

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NO. 2

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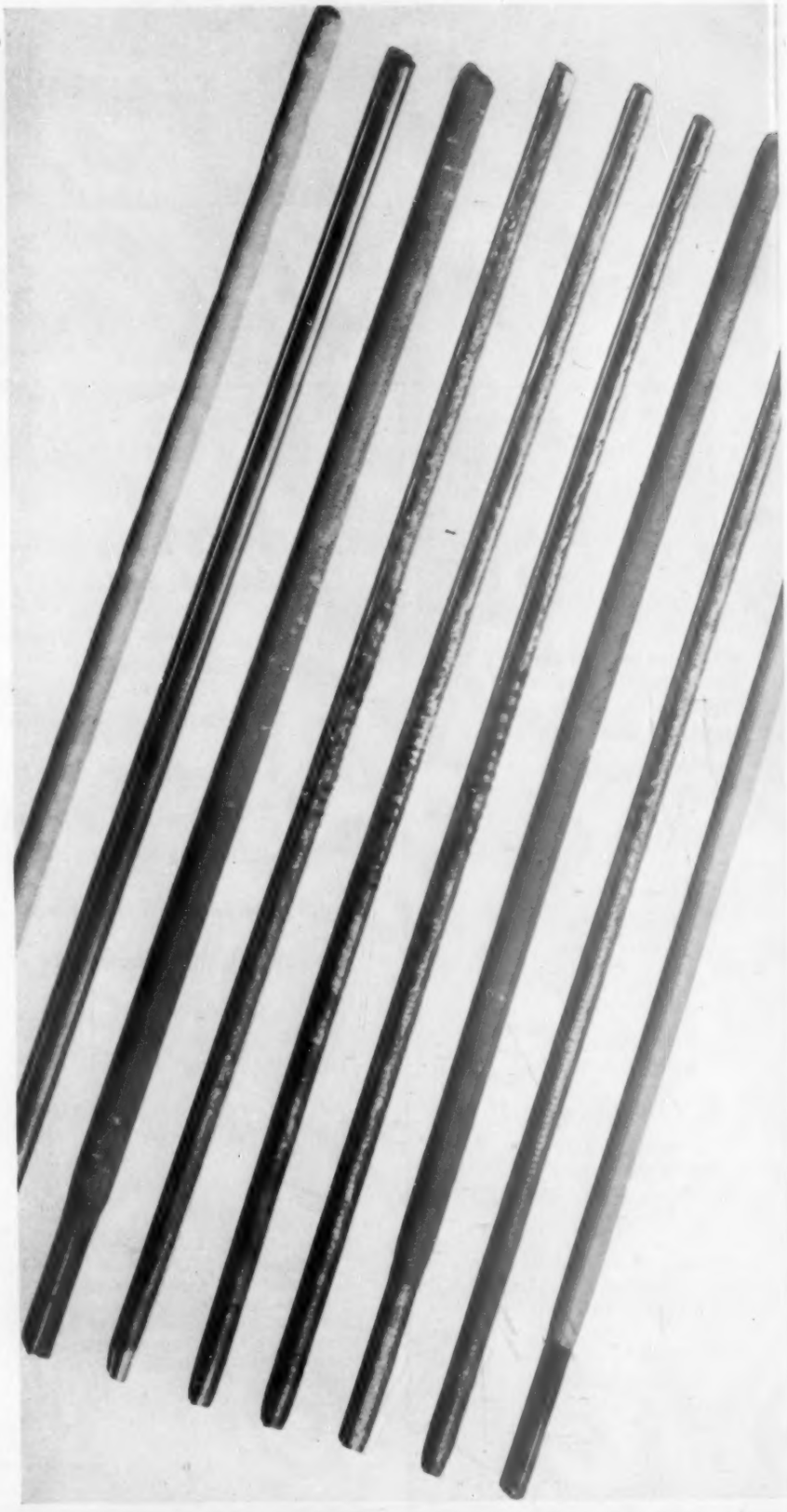

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I. A. A. To Meet in Southwest

THE FORTHCOMING convention of the International Acetylene Association, to be held in Houston, Texas, March 8, 9 and 10, focuses the attention of the industrial world on one of the oldest scientific societies in the United States. The history of the I.A.A. goes back to 1898, a few years after the discovery of calcium carbide and several years before oxy-acetylene welding and cutting had been developed.

Under the leadership of the I.A.A. the acetylene industry progressed from its early applications in the lighting of homes, mines, waterways and other isolated points, where an intensely brilliant light was needed, to its present extensive use throughout industry for oxy-acetylene welding, cutting and heating applications and as a base material for numerous chemical products.

Some of us, in close touch with only a few applications of the oxy-acetylene process, are struck with the scope of its activities when reviewed in a meeting such as the Houston convention promises to be. A current survey indicates that the following fields of activity in the oxy-acetylene industry are increasing in value as sources of profitable use:

(1) Small and large flame-cutting machines, both stationary and portable, have been developed to a wide range and versatility of application. Some of the smaller cutting machines, particularly, have now been adapted to practically all types of cutting operations, even to automatic templet guided cutting operations and the cutting of multiple plates in stacks. Through the ready availability of these machines, more shops will be able to avail themselves of the economies made possible through the use of flame cutting and welded fabrication.

(2) Fabricators are making increased use of selective flame-hardening and flame softening with the oxy-acetylene flame. These procedures have been developed to a high state of perfection in recent years, and are readily adaptable to large shop or small shop operations.

(3) Flame deseaming, either with hand-operated or machine-driven blow-pipes, is used for removing surface damage or defects from semi-finished steel, either in billet or slab form and is probably the latest and most spectacular application of the oxy-acetylene process. In the steel industry, the oxy-acetylene process is also widely used to shape cut steel to customers' orders and to heat it for bending and forming operations. Another comparatively new and growing operation is "descaling"—rapid removal of heavy scale from plate or castings with the oxy-acetylene flame.

(4) The blowpipe or torch is a very important tool in the repair and maintenance of equipment, especially in the automotive repair shops, in railroad work, in agriculture, and in steel mills. Practically every industrial plant utilizes the oxy-acetylene process for plant maintenance.

(5) The oxy-acetylene flame is of major importance in joining of non-ferrous metals by welding or bronze-welding.

(6) Other important welding applications include industrial and heating piping, sheet metal welding, butt-welded plate connections in structural work and light tubing such as airplane frameworks.

(7) Of special interest to the petroleum industry, so important in the Southwest, are the multi-flame tips which have been developed for the purpose of speeding production in overland pipeline welding. It is stated that savings in welding time with these new tips have ranged from 50 to 75 per cent for rolling welds and from 30 to 65 per cent for position welds, in comparison with single-flame welding. In the welding of deep-well casing the new multi-flame tips have made increased speeds possible. It is claimed that with a new four-flame tip designed for this work, two operators can complete a weld in 1½ minutes on 5 in. casing, or in 4 minutes on 10 in. casing.

(9) Outside of the welding field, acetylene applications are increasing in the chemical industry. Enormous quantities of acetylene are used annually in the manufacture of acetic acid, which is in turn the base for numerous synthetic chemical compounds. It may even be that within a few years the chemical market may be comparable to the welding market.

All of these applications and others similarly as interesting will be the subject of discussion at the coming I.A.A. Convention and if the enthusiasm and value which was the outcome of the 1937 convention in Birmingham is repeated, it will be an event which no industrial executive or worker in the great Southwest can afford to miss.

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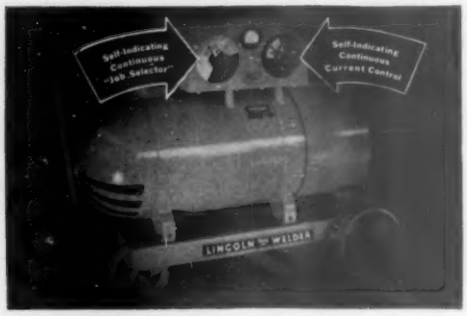

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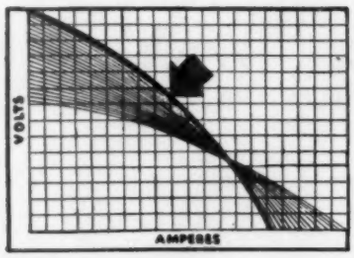

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Refinery pressure vessel lined with chromium alloy steel as protection against corrosion. Supporting skirt in foreground will be bolted to vessel in service. Typical of work done in accord with standard codes. Photo (A. O. Smith Corp.).

Review of process and operator requirements for

A.W.S. Qualification Procedure

★ Definition of function of an inspection agency—What is meant by the term, "qualified welder"?—Types of test specimens required to qualify

By W. D. HALSEY

Assistant Chief Engineer, Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

All power piping for high-pressure service must be welded according to code regulations and by operators who have been qualified.

IN ANY DISCUSSION of the inspection of welding, or of the qualification of welding operators, it may be well to give some thought to the question, "Why is inspection necessary and why should operators be qualified?"

One reason for the increasing call for inspection is the fact that welding is being used more and more for the fabrication of objects, the failure of which would result in extensive property damage and personal injury or loss of life. A second reason is that welding is not a process that can be lightly dismissed, but rather it is one that requires adherence to methods that have been proven to be satisfactory. A third reason is that the bulk of fusion welding is today done manually which at once introduces the personal factor.

From a paper by Mr. Halsey presented before A.W.S. Chicago Section lecture group at Armour Institute of Technology, January 23, 1939.

Almost without exception the failures of welding that have taken place in the past were caused by the use of improper materials or procedures and by the employment of welding operators who had never been properly trained. To be perfectly frank, there have been instances of dishonesty, such as the laying of a welding rod in the bottom of a groove and welding over it. Still being perfectly frank, such dishonest practices have at times been traceable to improper incentives to obtain quantity at the expense of quality.

Inspection of welding, therefore, is demanded on those classes of objects where failure might cause a disaster, to determine that a procedure for welding that is proper for the materials being welded has been developed and is being followed and also that the individual welding operators employed are competent to weld by that process.

It has been recognized as a sound principle that the process of welding used should be tested and that the individual welding operators should be proven competent. These two points are of prime importance in the construction of welded pressure vessels and pipelines, and they are also recognized as being of major importance for all applications of welding particularly where the work is done manually. This fact has been recognized by the American Welding Society which, several years ago, appointed a committee to draw up recommended rules to cover the matter. The first report of

the committee covering the manual arc and gas welding processes has been published as Chapter 34 of the A.W.S. Welding Handbook.

In a foreword to the "Standard Qualification Procedure" the committee made the following statement to the board of directors:

"The quality of a non-pressure welded joint will be determined by the specific process used and by the ability of the welding operator to apply that process. Predictable results as to the physical properties and soundness of such joints can be secured only by strict adherence to a fixed procedure of welding which has been properly investigated. It cannot be expected that good results will be obtained even by careful and painstaking workmen if poor materials, inadequate or worn-out equipment are used, or if fundamentally improper methods are pursued. Nor can the purpose of welding be attained by the mere adoption of a carefully outlined process of welding if the workmen are not adequately trained to follow that process, and properly supervised to be certain that all essential details of the specific process are followed.

"In non-pressure welding, the physical properties of the weld metal, such as tensile strength and elongation, will be determined by the particular process of welding that is used. The reliability of the welded joint will be determined by the degree to which that weld metal is kept free of foreign materials, such as slag, and by the degree to which it is fused to the base material. Under a fixed procedure of welding these two latter factors are the only ones over which the welding operator has control. It is considered unnecessary, therefore, to test every operator for tensile strength and elongation. It is the belief of your committee that the first step in welding must be the adoption of a procedure of welding in which all essential variables are fixed within definite limits. This procedure should then be investigated to determine whether it will produce welds with the desired physical properties. The tests required for a welding operator are included in the investigation of a welding process, because there have been many instances wherein failure to obtain results has been attributed to the inability of the operator, when the difficulty lay in the fundamentals of the process. Having established that a given process is satisfactory, comparatively simple tests may then be used for the qualification of welding operators."

I want to call particular attention also to the three opening sentences of the rules:

"These rules are intended to apply only to the manual application of the arc and gas welding processes, and to those metals which in their unwelded condition will meet the requirements of the guided bend test prescribed herein.

"Each manufacturer or contractor shall be responsible for the quality of the welding done by his organization and shall conduct tests not only to ensure welds which will meet the required tests, but also of the welding operators to determine their ability to properly apply the procedure.

"It is assumed that the manufacturer or contractor has an organization familiar with the various welding codes and capable of designing, engineering, and supervising welded construction."

Process Specification

Whatever may be the process of welding to be followed, it should be recorded as a process specification. The writing of such a specification may present difficulties to those who have not had much experience in welding. Such persons should obtain assistance from welding engineers who have had the necessary experience. It has been found in many shops that every welding operator has been permitted to follow his own ideas with the result that there have been, in those shops, almost as many welding procedures as there were operators. Some may have been doing good work in an intelligent manner, others may have been obtaining satisfactory results for reasons they could not explain, while still others were doing work that was far from satisfactory. Such a confused and disorganized manner of doing work is not healthful for any contractor or manufacturer.

In place of such conditions, which at times are almost chaotic, there can be substituted an orderly way of doing the work. The proper preparation of the parts to be welded, the proper welding rod or electrode, the proper size of electrode, the proper number of beads of welding, the proper welding heat, the proper size of welding tip and manipulation of welding torch are only some of the items that can be standardized in any given shop.

When a standard method of welding has been decided upon and recorded for future reference, a test should be made of that process to determine positively that it will produce certain results. It has been generally agreed that for most applications of fusion welding it is sufficient to determine that a process will produce welded joints of acceptable tensile strength, ductility, and soundness.

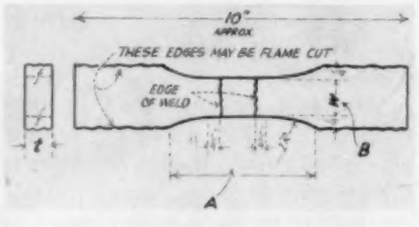

Fig. 1—Reduced section tensile test specimen for plate.

(A) Machining of this section should preferably be done by milling. Both faces of weld to be machined flush with plate.

(B) Width "W" is about 1½ in. where "t" is equal to or less than 1 in. Width "W" is about 1 in. where "t" is greater than 1 in.

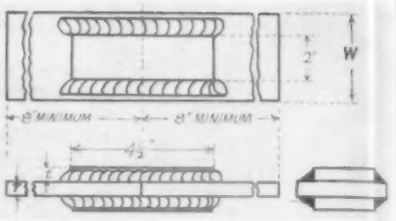

Fig. 2—Longitudinal shear test weld specimen.

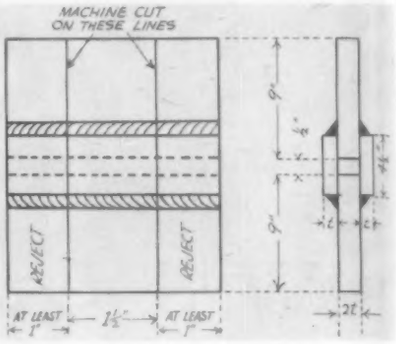

Fig. 3—Transverse shear test weld specimen.

Note—"t" equals specified size of fillet weld plus 1/16 in.

Types of Test Specimens

The form of specimen required for the tensile strength tests of butt-welded joints is that which has been specified for several years by the A.S.M.E. Unfired Pressure Vessel Code and is known as the reduced section tensile test specimen (Fig. 1). For shear strength of fillet welded joints, either two types of specimen are permitted—the longitudinal shear test or the transverse shear test (Figs. 2 and 3). For measurement of ductility the free bend specimen is called for. This type of test is also one that has been a standard in the A.S.M.E. Code for a number of years (Fig. 4).

Prior to the 1938 revision of the "Standard Qualification Procedure," soundness of welds was investigated by use of several types of specimens, all of which were to be broken open at the weld and examined for defects. While this method of examination is sound in principle, it is difficult to find a yardstick by which to measure the permissible amount of defects. What may be permissible by one observer might not be acceptable to another. There was needed a "go or not go" type of test and for butt welded joints this was found in the so-called jig bend or guided bend test that has been

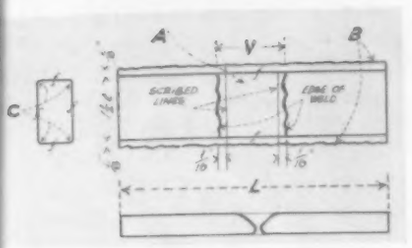

Fig. 4—Free bend weld test specimen.

(A) This surface to be reasonably smooth. Any tool marks remaining must be lengthwise of specimen.

(B) If coupons have been cut apart by flame cutting, the surfaces must be machined off as indicated.

(C) Round off corners to radius of not over 1/10 t. "f" indicates light finish cut. Weld reinforcement to be removed.

(L) Approximate minimum equal to 3 in. plus 3V.

(V) Width of surface of weld.

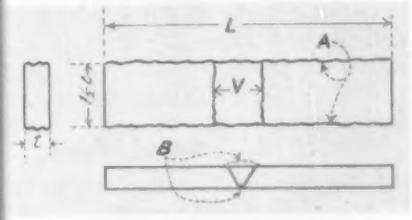

Fig. 5—Face and root bend weld test specimen for plate.

(A) These edges may be flame cut and may or may not be machined.

(B) Weld reinforcement (or backing strip) to be removed flush with surface of specimen. No undercutting, or defects below surface of specimen are to be removed.

(L) Approximate minimum equal to 3 in. plus 3V.

(V) Width of surface of weld.

used for several years by the U. S. Navy Department.

The specimens for this test are easily prepared, it being permissible to flame cut them from the test plate and grind off the reinforcement on the weld (Fig. 5). The guided bend tester consists of a U-block and plunger, the proportions given in the "Standard Qualification Procedure" being for test specimens having a thickness of ⅜ in. (Fig. 6). This type employs a hydraulic jack to make a tester that is rather compact, readily transported, easily operated and, last but not least, costs but little to construct. In fact one can be built for $25 to $30 including a first-class 5-ton hydraulic jack (Fig. 7).

A specimen to be tested is placed across the opening in the U block with the welded joint centrally located (Fig. 8). The plunger is then pressed against the specimen to force it into the U-block. It is required that a specimen shall withstand bending in the guided bend tester without showing a crack or tear, more than ⅛ in. long in the weld metal or between the weld metal and the base material.

The rules require that some of the specimens for the guided bend test shall be bent with the face of the weld in tension and others with the root of the weld in tension. When the thickness of the material is ¾ in. or more, the specimens are cut with a width of ⅜ in. and bent sideways rather than by root and face.

For soundness tests of fillet welded joints a so-called fillet weld break test specimen is used (Fig. 10). This specimen is to be broken open by blows concentrating a stress at the root of the weld (Fig. 11). This type of test is open to the objection that personal opinions enter into the judgment of the broken specimen and the "Standard Qualification Committee" is endeavoring to develop a type of test for fillet welds that, like the guided bend test for butt welds, will be a "go or not go" test.

In qualifying a process, test welds must be made in all positions that will be encountered in actual construction and all such welds must be subjected to the full series of tests. Test welds must also be made in one, two or three thicknesses of plate, depending upon the maximum and minimum thicknesses that will be used in actual construction. Furthermore, it is generally necessary that test welds be made in pipe, where pipe is to be welded, and fillet welds must be made for testing

"Standard Qualification Procedure"

This is the title of a 32-page bulletin issued by the American Welding Society, 33 West 39th St., New York City, covering the subject of process and operator qualification for manual arc and gas welding. Copies of the booklet will be sent postpaid by sending 25c to A.W.S. headquarters.

Part 1 of "Standard Qualification Procedure" details the tests required to qualify a welding process for code work. It explains in detail how test specimens are to be prepared and how many are required. Process qualifications for pipe welding are included.

Part 2 of "Standard Qualification Procedure" details the types of tests required and the number of test specimens required to qualify the welding operator for code work. Included are operator tests for pipe welding.

In the Appendix will be found suggested values for tensile strength, free bend elongation and soundness. These can be used at the option of the fabricator if values are not stated in the particular code which governs fabrication of the equipment. There are three suggested forms for process specifications covering oxy-acetylene welding, metallic arc welding, and carbon arc welding. These latter specifications are primarily of interest to the fabricator.

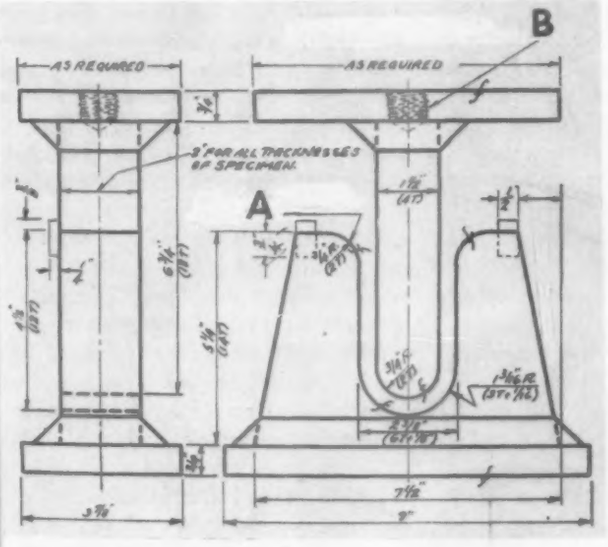

Fig. 6 — Guided bend tester comprises a "U" block and plunger. Sometimes called the "jig bend" tester.

(A) Shoulders hardened and greased. Hardened rolls may be used on shoulders if desired.

(B) Tapped hole for bolt to hold the jig in testing machine.

(T) Plate thickness. Dimensions shown are for ⅜ in. plate.

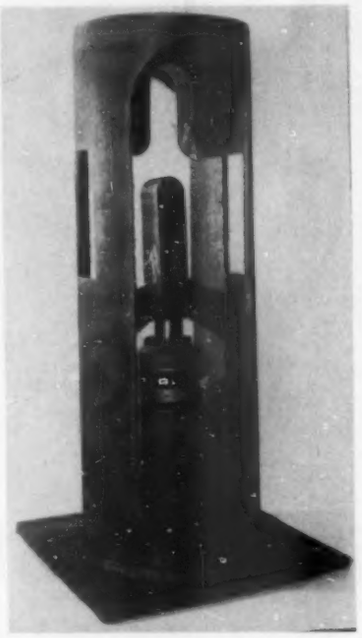

Fig. 7—Simple hydraulic jack test frame for the "guided bend" test as detailed in Fig. 6

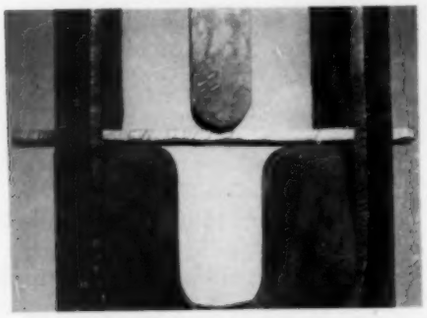

Fig. 8—Weld specimen in position ready for "guided bend" test.

Fig. 9—Completion of "guided bend" test. This is strictly a "go" or "no go" test, leaving nothing to individual judgment.

where fillet welds are to be used. The method of testing the pipe welds is similar to that used for plate.

Where special types of joints, whose nature would make the ordinary methods of testing difficult, are to be made, there is a requirement for an etch test. However, this is a special form of test and space will not permit a discussion of it here.*

Qualification of Operator

Up to this time we have been discussing the tests required for the qualification of a process. The same tests are required for the qualification of an operator, except that no tensile and free bend ductility tests are called for and the required range of plate thicknesses is less. For butt joints in plate or pipe, the guided bend test is the only one required. Where fillet welds are to be made a fillet weld break is necessary.

The "Standard Qualification Procedure" states that:

"For butt joints in plate, the operator shall make, for each process and position for which he is to be qualified, a test weld in plate ⅜ in. thick and such test welds shall qualify the operator up to and including a maximum thickness of ¾ in., except that if the procedure requires that the weld be made in a single pass in plate exceeding ⅜ in. thickness, then the test weld shall be made in the maximum thickness specified for a single-pass weld.

"If the operator is to be qualified for plate thicknesses in excess of ¾ in., he shall make an additional test weld for each process and position in the maximum thickness of material for which he is to be qualified, except that such maximum thickness need not exceed 1½ in."

There are similar requirements for operator qualification tests on pipe. When we analyze these test requirements we see that the operator qualification tests are comparatively simple. However, it must be borne in mind that a mere operator qualification test is not considered acceptable unless the process by which he makes the weld has previously been rather exhaustively tested. In this connection particular attention is called to Par. 1 of Part 2 of the "Standard Qualification Procedure" reading as follows:

"For the qualification of an operator under any welding process that has been qualified as outlined in Part 1, the following procedure shall be used. However, no production work shall be undertaken until both the process and the operator have been qualified."

It will be noted further that the comparatively simple guided bend tests now required for operator qualification are in marked contrast to the older practice of requiring every operator to make tests for tensile strength and ductility in addition to soundness.

The question may well be asked: "Why is a test weld in ⅜ in. plate or pipe thickness considered as evidence that the operator can satisfactorily weld plate or pipe with a thickness of ¾ in.?" Examinations of many defective welds that have failed, of many operator qualification tests, and analysis of the method of making a weld by either the metallic arc or oxy-acetylene process have been shown that the greatest difficulty encountered is in getting satisfactory fusion into the root of the joint. If an operator has the skill to do that he will have the skill necessary to deposit additional layers or beads of welding on top of the ⅜ in. thickness to build up the weld to a thickness of ¾ in.

It has been felt, however, that there should be an additional check on the operator for thicknesses above ¾ in. and, therefore, if he is to weld in material having a thickness in excess of ¾ in. he is required to make an additional test in that thickness, but such thickness need not exceed 1½ in. In other words, it is felt that if he shows he can weld in 1½ in. thickness he has thereby demonstrated he is competent to weld in any thickness.

I want to call particular attention to the fact that under ordinary circumstances the guided bend tester with the U-block and plunger, having the proportions I have shown, is the only tester necessary for operator qualification, for butt welds, for any thickness whatsoever. For the range of thicknesses up to and including ¾ in. the test weld is made in ⅜ in. thick material. For thicknesses above ¾ in. the specimens are made ⅜ in. wide and bent sidewise in the same tester.

Meaning of "Qualified Welder"

I have dwelt at length on the matter of procedure and operator qualification because they are essential factors in any kind of inspection work. However, while these factors must be emphasized they must not be considered as being a complete answer to the matter of getting a first-class job of welding. Before I discuss the matter of inspections I want to remark upon an opinion which seems to be prevalent regarding a "qualified welding operator." My interest is in seeing that, wherever welding is done, it will first be given adequate consideration by a competent welding engineer, and second that the welding is done by competent or so-called "qualified welders."

And just what is a "qualified welder?" We can take an intelligent young man, give him the proper tools and materials and a thorough, but comparatively limited, amount of instruction and training in the proper way to weld a ⅜ in. plate. In a comparatively short time we can train that man to make a weld that will pass the qualification test I have described, at least in the flat position. When he passes that test he would be commonly referred to as a "qualified welder."

Let us leave this "qualified welder" for a moment and consider another young man who has been brought into a shop and, without any previous knowledge of machine tools, is trained to turn some simple cylinders of metal to a certain specified tolerance. When we think he has learned the job, we ask him to produce a specimen on his own.

*Refer to A.W.S. "Standard Qualification Procedure," copies of which can be obtained for 25c from A.W.S. headquarters, 33 West 39th St., New York City.

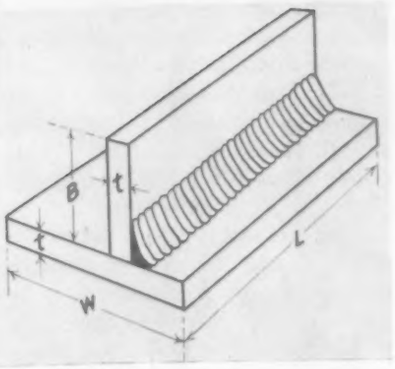

Fig. 10—Fillet weld break test weld specimen.
(B) Approximately 4 in.
(L) Not less than 4 in. but need not exceed 6 in.
(W) Approximately 5 in.
(t) Equal to size of weld plus 1/8 in.

We measure it with a micrometer and find it satisfactory. Would we call that individual a "qualified machinist"? I trust you will see the point I am trying to make, which is that a "qualified welder" is being looked upon by the public as an individual who knows all that there is to be known about welding. Actually, he may be only one who has demonstrated that given certain materials and equipment he can, under certain conditions, make a weld that, when tested, will meet certain requirements. But we all certainly appreciate that for welding to develop and find wider uses, more is required than mere ability to wield a torch or manipulate an electrode.

Function of Welding Inspection

Good welding requires welding engineering, plus competent welding operators. Inspection of welding intends to see that both are used. Inspection is in itself not welding engineering. Inspection must demand proof that whatever is done in welding has been found satisfactory by previous tests or research, but inspection itself does not intend to make those tests or conduct research. Inspection is demanded by code regulations on certain applications of welding and in such cases inspection is bound, not by individual opinions, but by the specific requirements of such codes.

How is inspection of welding carried out and what are some of the tools that have been used to aid in inspections? Inspection starts with design, which means that the design of the object must be checked with the requirements of any code that may apply or that has been specified. The quality of the material to be welded must be ascertained and this is best accomplished by having the material manufacturer mark or stamp the material for identification and furnish a mill test report. The preparation of the adjoining parts to be welded and the fit-up of those parts before welding is started, must be checked to determine that the standards of the proven procedure are being adhered to. The inspector must satisfy himself that the welds are being made in the manner specified in the proven procedure and that the work is being done by competent welding operators.

Whenever he witnesses any actual gas welding operation, the inspector is observing whether, (1) the proper nature of flame is being used, (2) penetration into the root and fusion with the side walls are being obtained, and (3) the molten metal is being so controlled that it is not flowing on to base metal that is not ready to fuse.

On metallic arc welding operations he is observing whether a reasonable arc length is being maintained, penetration into the root and side walls is being obtained, the welding "heat" or amperage is sufficient to insure good fusion, and that fused slag is not running ahead of and being entrapped in the weld. He pays particular attention to any side wall undercutting that may occur and requires that the condition be corrected to avoid side wall slag inclusions on subsequent beads. In this respect much can be done in observing the surface appearance of each welding bead immediately after it has been deposited and the slag coating removed. With the heavily-coated electrodes available today one can predict with a high degree of accuracy by the surface appearance, whether clean metal well fused to the base material has been deposited.

The inspector looks for cracks and excessive porosity and requires that such defects be removed before the subsequent bead of welding is deposited.

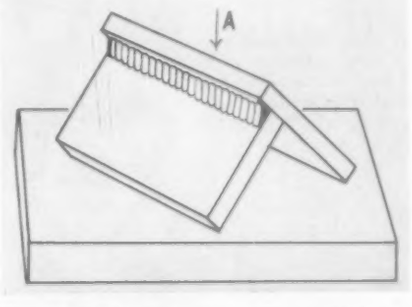

Fig. 11—Method of testing fillet weld break specimen.

On some classes of work examination by x-ray or radium is required. For a popular description of these methods we might say that either radium or the x-ray tube give off a form of light that is capable of passing through steel. A photographic film placed against the welded joint and on the side opposite the radium or the x-ray tube will be affected by the rays and a shadow picture of the weld will result. If there are voids or slag inclusions in the weld they will appear as dark shadows on the film.

It is part of the duty of the inspector to examine the x-ray films and see that the defects shown thereon do not exceed some previously determined standard.

Flaw Detectors

Surface cracks in welds can be detected by the magnetic dust or magnaflux method of inspection. The method consists of magnetizing the object, at least at the point to be examined, by one of several methods. If iron filings are sprinkled on the weld, they will congregate and adhere to the weld at any surface crack, because of the disturbance of the magnetic field at that point. For positive results, the method seems to be limited to surface cracks, although it is true that on occasion certain kinds of surface defects have been detected by this means.

Another means that has sometimes been used to detect flaws in welds is the stethoscopic test. An ordinary physician's cone type stethoscope with a gum rubber cover is held against the object adjacent to the spot to be tested. The object is then struck with a small hammer. The sounds given off by those parts which do and do not have defects will be different. While the method has been used it would seem that considerable experience must be obtained, before the sounds can be correlated to defects and furthermore the acuteness of the sense of hearing varies greatly.

The three kinds of tests just described—x-ray, magnetic dust, and stethoscopic—are all non-destructive. None are perfect or complete and all must be applied with the proper technique in the hands of trained persons. All have the advantage that, if the persons—both the manufacturer and the individual operator—doing the welding have prior knowledge that the work is to be so examined, they will strive to do their best.

A method of testing that has sometimes been used is accomplished by trepanning plugs from the finished weld. An examination of the plug gives a clear picture of the seam at the point where the plug is removed. The method is not and was never intended to be as searching as x-ray examination. However, if several plugs are removed, a fair idea of the general workmanship and soundness of the seam may be obtained. On new construction, if there is prior knowledge that this method of examination will be used, the moral effect will be good and on new work this is the greatest value of this method.

In the inspection work with which I have had contact I have been struck very forcibly by the rather general lack of competent supervision in the industry. I do not mean to say that there is no supervision, but I do most emphatically state that many of the defects that have been found and many of the failures of welding that have taken place have been directly traceable to lack of supervision by some one who fully appreciates the do's and don'ts of welding. An inspector, however, is not a supervisor and no one should expect that by calling for inspection that the inspector will direct how the work shall be done.

When industry, in general, awakens to the necessity for proper supervision in welding a change is going to take place in the opinion that many now hold. Many restrictions now imposed on welding will be removed.

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Transformers for Electric Resistance Welding

By I. H. SCLATER*

★ Electric welding is playing a more and more important part in our modern industrial life. Many of the electric welding operations of the spot, resistance, flash, projection and percussion type are automatic and continuous. These exacting production schedules require electrical apparatus specially designed to meet rigorous operating conditions.

As the transformer equipment is the heart of these welding machines, an extremely high standard of reliability is essential. The problems encountered have taxed the skill of designers, old materials have been used in new ways, and new materials have been used in both old and new ways.

Transformers for this service should have insulations which are heat-and moisture-resistant and which will not deteriorate under the repeated heating and cooling cycles. For maximum economy in operation, core steel of high-grade silicon steel, free from burrs and annealed after punching, should be used to assure low core loss and low exciting current.

In order to minimize the size of the transformers delivering many thousand amperes, artificial cooling has been used. This is accomplished by circulating water through the secondary winding. The most efficient method is to construct this secondary of a number of hollow tubes of high-quality, oxygen-free copper. The selection of the tube size is governed by a thorough study of the best utilization of material and transformer characteristics. The temperature rise of the cooling water should be limited to about 10 deg. C., resulting in actual temperatures which, conservatively, are below temperatures tending towards precipitation of impurities in the water and consequent corrosion of the copper tubes making up the secondary.

By using a relatively narrow secondary and primary winding and by properly interleaving the high- voltage and low-voltage windings, it is possible to obtain the characteristic of low reactance. From the standpoint of voltage regulation, this is highly desirable in this class of equipment, because welding transformers have an extremely high instantaneous current demand at low power-factor. Interleaving also results in rapid heat conduction, preventing hot spots which shorten the life of insulation. It also allows the designer to use a smaller, more economical cross-section of copper in the windings.

Asbestos-covered wire has many advantages for use in primary windings. This wire is first covered with high-grade African metal-free asbestos; then it is treated with special heat-resistant compound. This gives a mechanically strong covering, both heat and moisture resistant. Mica strips between adjacent turns insure proper turn-to-turn insulation when properly clamped to avoid mechanical destruction.

Mica collars between coils have many advantages. Mica is both an excellent insulator and a reliable heat conductor. The latter quality is especially important in transferring to the water-cooled secondary the heat caused by the primary copper loss.

All joints and tap connections in the transformers should be electrically brazed, to insure maximum reliability. The parts to be so joined are tightly clamped and heated to a fairly high temperature by passing a heavy electric current through the clamps and parts to be brazed. At this elevated temperature the brazing alloy melts and flows uniformly between the parts being brazed, forming a joint with electrical and mechanical characteristics as good as those of the original copper. Joints made in this way are far superior to those made with the conventional soft solder, especially where high operating temperatures may be expected.

Primary taps and secondary terminals of 35 kva. water-cooled welding transformer, 550 to 5.18/2.57 volts.

* Engineer, Power Transformer Dept., General Electric Co., Pittsfield, Mass.

Houston is the leading city of Texas and very important as an oil port. Located 50 miles from the Gulf on the Houston ship channel.

Preview of technical program planned for

I. A. A. Meeting In Houston

★ Oxy-acetylene applications in the oil industry will feature this meeting, which will be held for first time in the Southwest

LEADING REPRESENTATIVES of industry from all sections of the country will appear on the program of the 39th annual convention of the International Acetylene Association, to be held this year in Houston, Texas, on March 8, 9 and 10. Users and fabricators of metal products will undoubtedly find the program of practical value and interest, as it will include papers on many recent and interesting developments of the oxy-acetylene welding and cutting processes and their applications in industry. We present an outline of the tentative program for the Houston convention (meetings will be held in Rice Hotel):

WEDNESDAY—MARCH 8th

12:15 P.M.—Opening Session

Features will be the address of welcome by J. W. EVANS, vice-president U. S. Chamber of Commerce, Houston; the keynote address by J. H. VAN DEVENTER, editor, *The Iron Age*, New York City; the opening address by ELMER H. SMITH, president of International Acetylene Association; and the presentation of the Morehead Medal.

FIRST TECHNICAL SESSION GROUP

(Two Simultaneous Meetings)

2:30 P.M.—Session "A"

"Welding and Cutting in Petroleum Refining."

Chairman: R. L. DUDLEY, president, Gulf Publishing Co., Houston.

Papers to be presented:

"Oxy-Acetylene Welding of Piping in Petroleum Refineries."

HENRY JOUETTE, Magnolia Petroleum Co., Beaumont, Texas.

"Welding Fittings."

E. HALL TAYLOR, Taylor Forge & Pipe Works, Chicago, Illinois.

"Oxy-Acetylene Welding of High-Pressure Piping."

A. N. KUGLER, Air Reduction Sales Co., New York, N.Y.

2:30 P.M.—Session "B"

"Welding and Cutting in Petroleum Production and Distribution."

Chairman: L. H. COURTWRIGHT, welding foreman, Reed Roller Bit Co., Houston, Texas.

All meetings of the I.A.A. will be held at the Rice Hotel shown here.

Papers to be presented:

"Gas Welded Oil Well Casings."
G. R. MILTON, Sinclair Prairie Oil Co., Arp, Texas.
"Review of Latest Practices in the Pipe Line Field."
A. D. GREENE, vice-president United Gas Pipe Line Co., Houston, Texas.
"Maintenance of Oil Field Equipment."
C. G. ALHART, Texas Iron Works, Houston, Texas.
"Oxy-Acetylene Application of Hard-Facing Materials to Drill Bits."
CHARLES H. SHAPIRO, chief metallurgist, Reed Roller Bit Co., Houston, Texas.

8:15 P.M.—Round Table Discussion

Demonstration meeting followed by simultaneous group meetings for open discussion of practical problems of welding and cutting.

General Chairman: H. C. BOARDMAN, president, American Welding Society; consulting engineer, Chicago Bridge and Iron Co., Chicago, Illinois.

Demonstrations to be made of:
Flame Hardening, Hard-Facing, Testing, Casing Welding.

Subjects to be discussed:
Flame Hardening, Fire Prevention and Safety, Non-Ferrous Metals, Alloy Steels, Hard-Facing, Testing of Welds, Oil Well Casing Welding, Salvaging and Reclamation, Safe Ending of Boiler Tubes.

THURSDAY—March 9th

12:15 P.M.—Annual Luncheon and Business Meeting

Address by GEORGE A. HILL, vice-president, American Petroleum Institute; president, Houston Oil Co., Houston, Texas. Reports of Committees. Election of Officers.

Chairman: ELMER H. SMITH, president, International Acetylene Association.

2:30 P.M.—Second Technical Session

"Surface Hardening and Hard-Surfacing." A special lecture, followed by a panel discussion led by the chairman.

Chairman: DR. A. B. KINZEL, chief metallurgist, Union Carbide and Carbon Research Laboratories, Inc. New York City.

Paper to be presented:
"Surface Hardening and Hard Surfacing."
C. E. MACQUIGG, Dean, College of Engineering, Ohio State University, Columbus, Ohio.

Participants in the panel discussion:
JOHN J. CROWE, research engineer, Air Reduction Sales Co., New York City.
ERNEST E. THUM, editor, *Metal Progress*, Cleveland, Ohio.

FRIDAY—MARCH 10th

8:15 A.M.—Plant Inspection Trip

Hughes Tool Co., Houston, Texas.

THIRD TECHNICAL SESSION GROUP
(Two Simultaneous Meetings)

2:30 P.M.—Session "A"

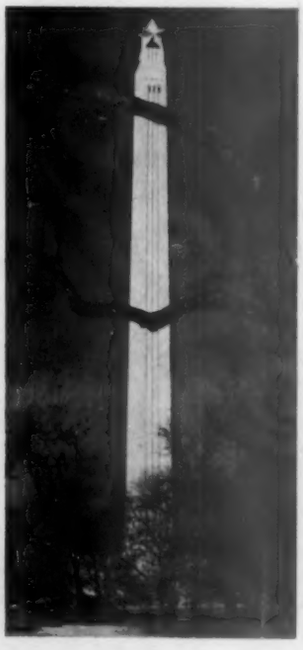
"Machine Oxy-Acetylene Cutting."
Chairman: A. I. SELLERS, superintendent of shops, Southern Pacific R.R., Houston, Texas.

Papers to be presented:
"Flame Cutting with Small Machines."
WALTER B. VANWART, vice-president, Wyatt Metal & Boiler Works, Dallas, Texas.
"Oxy-Acetylene Shape-Cutting of Drilling Equipment Parts."
L. W. STAHL, Emsco Derrick and Equipment Co., Houston, Texas.
"Plate-Edge Preparation"
J. H. TROGER, Federal Shipbuilding and Dry Dock Corp., Kearny, N. J.
"Economics of Machine Gas Cutting."
G. M. DEMING, Air Reduction Sales Co., New York City.

2:30 P.M.—Session "B"

"General Applications of the Oxy-Acetylene Process."

Papers to be presented:
"Plumbing, Heating and Air Conditioning."
FRANK WALLACE, C. Wallace Plumbing Co., Dallas, Texas.
"Safe-Ending of Boiler Tubes"
FRANK PAGE, chief boiler inspector, State of California, San Francisco, Calif.
"Flame Hardening of Oil Field Equipment."
M. O'HARA, International Derrick & Equipment Co., Beaumont, Texas.
"Agricultural Uses of Welding and Cutting."
MILLS P. BYRON, Agricultural Experiment Station, College Station, Texas.



San Jacinto Memorial Shaft, one of the historical points of interest to the visitor in Houston.

The Round Table Discussions will be held at the San Jacinto High School. The Group Meetings will be held simultaneously, and each will be in charge of a group chairman who will be assisted by guest technical advisers, who will be authorities on the subjects under discussion.

Facts About Houston

Houston is the largest city of Texas, with a population of 318,000 and is said to rank fifth in importance as a U. S. port. The city is located 50 miles from the gulf on the Houston ship channel. The opening of this channel to tidewater in 1915 presented an opportunity to establish large manufacturing enterprises with direct connection to deep water. There are cement mills, oil refineries, fertilizer plants, pulp and paper mills, warehouses, shipyards, etc. located along this channel, with docking space for a total of 60 vessels. The dredging program, started in 1933, is now completed, affording a depth of 34-35 ft. and a width of 400 ft. across Galveston Bay, and a width of 150 to 250 ft. from there to the turning basin (diameter 1100 ft.).

Houston is essentially an oil port, because it is in the midst of the Texas coastal oil fields with pipelines radiating in all directions to the great producing fields of the Southwest. Storage capacity adjacent to the ship channel is about 40 million barrels with excellent bunker oil facilities. The oil tonnage has meant more to the Port of Houston than all other commodities combined. There are nine huge refinery plants with a capacity exceeding 3,000,000 barrels of crude oil per day. It is estimated that the oil industry has an investment of 150 million dollars along the 25-mile waterway. Many of the leading manufacturers of oil country tools and equipment have established plants or branches in Houston.

Houston leads all the Texas industrial regions in value of manufactured goods. According to the last Federal census of manufacturers, the annual value of manufactured goods exceeds 222 million dollars

3-Ton Cast-Iron Base Repaired by Bronze Welding

★ A cold header machine whose cast-iron base had cracked in two places, was successfully repaired by bronze-welding, and is now operating under conditions of unusual severity in a bolt factory.

The cold header machine, which derives its name from the process of forming the heads of ½-in. bolts from cold stock, is subject to terrific impact. Approximately 250,000 lbs. pressure is needed to shape the heads from cold steel. Since the cast-iron base has to stand this shattering force 70 times per minute, there is little wonder that the original casting, after years of service, finally gave way and cracked in two places. The base weighed 3 tons and the cracks occurred in sections that were from 5 to 7 in. in thickness.

Faced with the prospect of costly replacement and a shut-down while waiting for the delivery of a new base, the company officials decided to repair the base by bronze-welding. As the job was much larger than any that had been done previously by the plant welding operators, the advice of an oxy-acetylene service operator was requested, and the repair made under his supervision.

The cracks, one of which measured 7 in. by 12 in. and the other, 5 in. by 7 in., were prepared for bronze-welding by careful veeing to afford full penetration of the bronze. Then, in order that no unequal stress might occur in the large casting during the welding operation, it was carefully preheated and an asbestos shield placed over it to conserve the heat.

With everything in readiness, two operators began the bronze-welding operation, using Oxweld Type W-17 blowpipes equipped with extra long heads. Welding time amounted to 8 hr.

The machine was returned to service, and the cast-iron base has given steady, dependable service ever since, a factor which demonstrates the excellent strength of bronze-welds. Although the economy of bronze-welding is already well known, attention might be called to the great savings that can so readily be realized through its use. The cost of replacing this casting would have been $1,100, while the expenditure for bronze-welding amounted to only $60.

Increased comfort for the operator and higher speed in bronze welding are obtained by use of extra long welding blowpipe.

Repaired casting showing extent of crack which was bronze welded.

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H. C. Price Co., Bartlesville, Okla. has been awarded contracts for arc welding the following pipelines to be operated by Illinois Pipe Line Co.: Sheehan Pipe Line Construction Co., 158 miles of 10 in. and 12 in. line in Indiana and Ohio. White Deer Pipe Line Construction Co., 54 miles of 8 in. line in Illinois. These new lines are to afford increased pipeline capacity for transporting oil from the Southern Illinois fields to refineries in Ohio.

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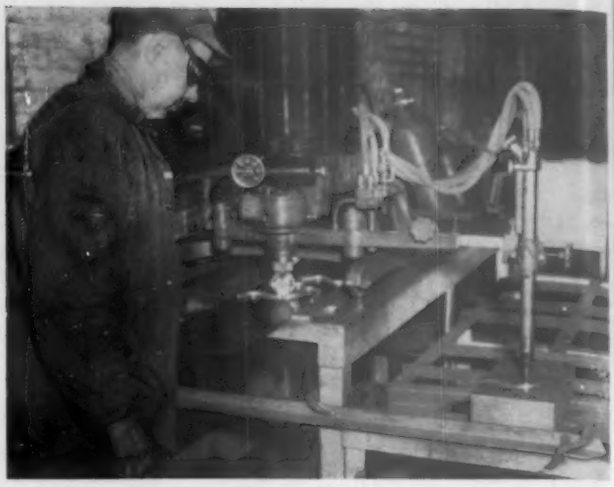
Humble Pipe Line Co. plans immediate construction of a 21-mile welded pipeline from the Fitzsimmons field in Duval county to its plant in Benevides, Texas.



Stack cutting increases production and effects saving in material.

A review of the currently outstanding

Oxy-Acetylene Developments

★ Multi-flame tips are permitting greatly increased speeds on pipeline and casing welding—Flame hardening and softening, and flame conditioning opening new fields of usefulness

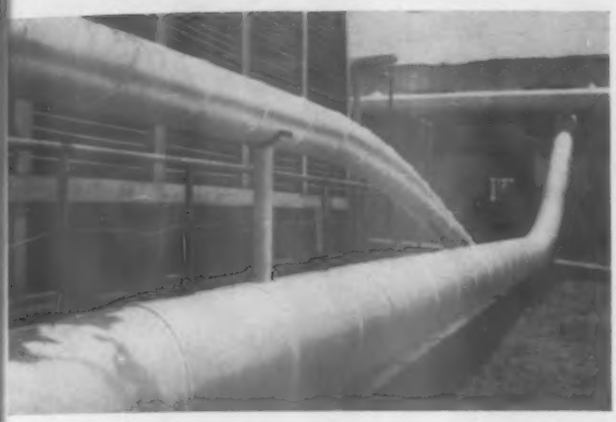
NEW OXY-ACETYLENE cutting machines and new cutting procedures, such as stack-cutting, are revolutionizing machine design requirements and manufacturing operations. New multi-flame tips and welding rods are speeding the welding of pipelines 25 to 75 per cent it is reported. New welding techniques are extending greatly the usefulness of the new corrosion-resistant steels that permit light-weight construction. New developments in processes such as flame-hardening, flame-softening, and deseaming are introducing new conceptions in the art of metal-working.

In the fabrication of iron and steel products, the oxy-acetylene process shapes steel to meet all sorts of special requirements, heats steel to facilitate all manner of bending and forming operations, hardens steel surfaces which must resist wear, and softens other surfaces where hardness is undesirable. Finally, the process is used for a variety of special operations of which flame-conditioning (the removal of surface defects from steel in semi-finished form) is one of the latest and most spectacular.

The oxy-acetylene flame is widely recognized as a rapid and economical means for joining metals. Here, the trend has been along lines of more effective utilization of heat. This has resulted in the use of multi-flame tips and the mechanization of the motion of the blowpipe with respect to the work, particularly in the case of repetitive production operations.

Besides the new techniques and new operations, the oxy-acetylene process is branching into new fields and tackling new jobs. Although space does not permit more than a brief summary of the recent developments, it is hoped that the following review of the highlights will prove helpful in indicating how the oxy-acetylene process is aiding the metal-working industry in speeding production, improving quality, and reducing costs.

Using new 4-flame tips, this 5-in. well casing joint was welded in 2½ min.



This oil refinery piping was oxy-acetylene welded by the Linde weld process, using 4-flame tips.

Cutting Machines

In the field of machine-cutting, developments during the past year have centered along two lines—(1) increasing the range and versatility of portable cutting machines, and (2) the development of new procedures for these, as well as for the larger stationary machines.

With the new attachments available for the small, portable cutting machines, it is now possible for these machines to handle practically all cutting requirements, with exception of automatic templet tracing. Typical operations include straight-line cutting, bevel-cutting, shape-cutting, and circle-cutting. Another important development has been the introduction of medium-size portable shape-cutting machines. These machines will operate with one or two blowpipes and will cut any desired shape either by hand-tracing or by means of standard templets.

Stack-Cutting

Stack-cutting, or the cutting of piled plates, is another important development that has speeded production considerably. By means of stack-cutting, it is possible to produce quickly and economically quantity lots of thin steel sheets of any size and shape.

Lift brackets for rolling doors are cut twelve at a time out of ¼-in. piled plates. The plates are first clamped together, then a welding bead is run down each side of the center scrap section to hold the plates in intimate contact during the cutting operation. The blowpipe is guided by an aluminum templet.

Multi-Flame Pipe Welding

New multi-flame tips have resulted in a remarkable increase in the speed of overland pipe welding. One manufacturer has developed a 4-flame tip for position welds and a 6-flame tip for rolling welds. With these new tips, savings in welding time have ranged from 50 to 75 per cent for rolling welds, and from 30 to 65 per cent for position welds over single-flame welding. Considerable economies are also realized in the consumption of gases and welding rod.

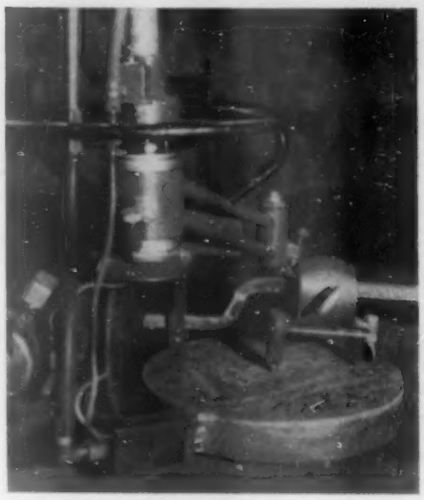
A further step was the introduction last year of a new low-alloy steel welding rod which develops an average tensile strength 10,000 to 12,000 psi. greater than rods previously used for pipe welding.

The new tips and rod are not confined solely to use on overland pipelines. Recently 14,000 ft. of 4-in. pipe was installed in an oil refinery for handling a chemical foam solution used to extinguish fires. In the first three days alone, two operators welded over 5,500 ft. of the piping, using 4-flame tips and the new low-alloy steel welding rod.

Within recent months, multi-flame tips have come into use for welding oil well casing. In the welding of deep-well casings, the increased speed possible with the new tips is important, as a delay in the sinking of casing may cause the drilled hole to become clogged. Deep-well casing is usually welded into 80-ft. lengths before it is swung into position for the tie-in weld. With the new 4-flame tip designed for this work, two operators can complete one of these tie-in welds in from 1½ to 4 min., in casing ranging from 5 to 10¾ in. in diameter.

A 10-flame head is used on this automatic machine for seam welding barrels. Production rate—75 to 100 barrels per hr.

Machine welding with the use of multi-flame heads is also contributing greatly to increased speeds in the manufacture of certain metal products. Whenever parts are produced on a quantity basis, and the same type of weld is made over and over again, it is frequently expedient to use multi-flame heads and mechanize the motion of the blowpipe with respect to the work. Production is not only speeded, but a neater, smoother weld is also produced.



Application of flame softening on flame-cut gear blanks of S.A.E. 1045 steel.

Flame-Hardening

As a means for hardening the wearing surfaces of steel and iron parts, the use of the oxy-acetylene flame is still very much in its infancy. Yet, during the past year flame-hardening has grown by such leaps and bounds that at the end of 1938 there were already countless applications for this process. Flame-hardening offers many advantages for the localized hardening of wearing surfaces.

Typical of the more recent applications is the use of the oxy-acetylene flame for hardening cylindrical objects, such as calender rolls used in paper making, rolls used in the processing of sheet rubber products, steel mill rolls, leveling rolls, and the bearing areas of shafts. These cylindrical objects are usually hardened in a vertical

Surface defects are removed from semi-finished steel by oxy-acetylene deseaming, a revolutionary idea in steel mill practice.

position by the progressive spinning method.

One of the largest jobs thus far handled was a 12-in. diameter, 108-in. long calender roll of forged S.A.E. 1045 steel. This roll was hardened in a vertical position with twenty-four 7-flame heating heads progressing from the bottom to the top of the roll at a speed of 4 in. per min. The roll was spun during the hardening operation, and the whole job took ½ hr. A surface hardness of 600 to 650 Brinell was obtained. This roll has now been in service six months and, as yet, shows no sign of wear.

Rubber rolls present an ideal application for flame-hardening because the engraved designs on their surfaces must be distortion-free and as wear-resistant as possible. Even slight damage of the engraved surface means that the rolls are beyond repair. A typical job consisted of hardening a 10-in. diameter roll to 700 Brinell with twenty 7-flame heating heads. In spite of the corrugations on the surface, a uniform hardness as well as uniform depth of hardness was obtained over the entire roll surface.

Flame-Softening

Flame-softening is another instance of the recent trend towards more efficient heat utilization by means of multi-flame heads. As a means for removing the undesirable hardness along the flame-cut edges of low-alloy high-strength structural steels, flame-softening is making possible the more economical fabrication of these steels. The process is an important contributing factor towards the greater usefulness of these steels for structures where high strength and light weight are of paramount importance.

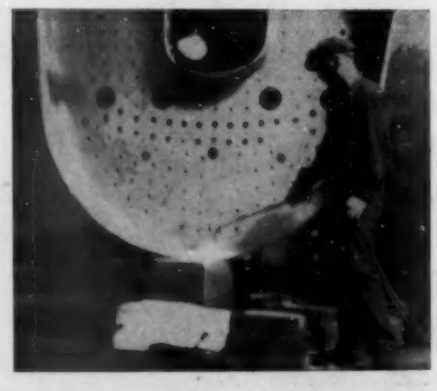
The use of the oxy-acetylene flame for straightening, bending, forging, and forming operations, while not new, has expanded rapidly within recent months. Multi-flame heating heads and large-capacity heating blowpipes make it easy to utilize all the advantages of the oxy-acetylene flame as a convenient source of intense, localized heat. The efficiency and portability of modern oxy-acetylene heating equipment, and the savings in time and reduction of floor space, are opening the way towards important developments in the practices of the industrial blacksmith shop.

Flame-Conditioning

One of the most spectacular of all recent oxy-acetylene developments is the use of the process for removing surface defects from semi-finished steel.

Most steel in semi-finished form—blooms, billets, slabs,—has certain surface defects such as small cracks, which if not removed will appear ultimately in the finished products. For a good many years various methods have been used to remove these defects. It has only been with the recent use of the oxy-acetylene process that the removal of surface defects has been placed on an efficient and economical basis.

Hard-faced pads on these sleeves assure proper running clearance of work rolls.



Forming operations on heavy locomotive boiler plate are greatly speeded up by using new type heavy-duty heating blowpipes.

Hard-facing lugs used for mooring and anchoring cables of seaplanes.

Various terms are used to describe the process such as deseaming, desurfacing, scarfing, and flame-conditioning. Deseaming is generally applied to hand operations on cold slabs and billets. Here, specially designed blowpipes are utilized to "wash off" sections of the surface that contain the imperfections. Sufficient steel in the vicinity of the defect is removed to eliminate the defect itself and leave clean, sound steel.

The term flame-conditioning, on the other hand, is used to describe the process in general, and, in particular, the special oxy-acetylene machines which remove the entire surfaces of blooms, billets, and slabs whether hot or cold. These new machines now make it possible to remove defective surfaces as a part of the continuous rolling process. It is the long-sought answer to the steelmaker's most perplexing problem—the uninterrupted production of steel from ingot to finished form.

Hard-Facing

Prominent among trends in hard-surfacing has been the standardization on this process by oil field operators. New designs of tungsten carbide inserts now meet practically all drilling bit requirements for oil and water wells. The new inserts have an improved cross section which not only prevents them from rocking out of

place when laid on the bit for hard-setting, but also assures the strongest possible bond between themselves and the surrounding steel.

Hard-faced shares are now used to plow the ocean floor when laying trans-oceanic communication cables. Many parts of production machinery, too, are being protected with hard-facing alloy. A typical instance is the use of wear strips of hard-facing alloy for protecting boring bars from chip abrasion. Another example is the hard-faced shoes used to guide hot billets and blooms in the flame-conditioning machines previously mentioned. Hard-facing is also being used on large power projects for such applications as dredge blades, pump shells, impellers, face plates, and discharge ells.

Valves for handling steam at the pressures and temperatures used in modern utility and other plants are protected against wear, erosion and wire-drawing by a trim of hard-facing alloy applied by the oxy-acetylene process. Such alloy-trimmed valves have come into wide use because of their long life and time proven economy in severe service.

Exhaust valves and valve seat inserts, hard-faced by the oxy-acetylene process, have become standard in many types of heavy-duty internal combustion engines. Their long, trouble-free life has improved performance and lowered operating and maintenance costs of engines for trucks, buses, aircraft, diesels and industrial motive power units.

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Oil Well Drilling Bits Are Hard Faced With Tungsten Carbide

★ Material specifications for oil well drilling bits are rigid. Although this steel is a composite of several alloys it must be sound and tough enough to withstand severe stress and shock while drilling. Alloy steel for bits is made in the electric furnace. After it is cast it is machined to size and high spots on the wings are ground off with a flexible grinder. Next, the grooves are ground in the reaming edges to hold the wear-resistant tungsten carbide inserts.

After cleaning and preliminary grinding, the cutting blowpipe is often used for trimming and squaring the cutting and reaming edges. The hard-facing and hard-setting materials are placed for the next operation.

Cutting blowpipe is used for squaring and trimming the cutting and reaming edges.

Tungsten carbide inserts placed in position on one wing of drilling bit, ready to be "set" with the blowpipe.

When the bit is correctly shaped, cast tungsten carbide inserts are placed in their approximate positions on one wing, and the blade and inserts are brought to a full red heat with the welding flame before the inserts are set.

An insert is then picked up with a high-strength steel tying-in rod. The heat of the flame is directed at the spot in which the insert is to be set, so as to assure full melting of the steel in that area during hard-setting.

Each insert is buried in the molten metal individually. When all the inserts have been placed and bonded thoroughly, tying-in rod is added to cover each insert completely with a thin layer of high-strength steel.

When all inserts have been bonded in place, a "tying-in" rod of high-tensile steel is used to provide a thin steel covering over each insert. Next operation is hard-facing each wing using "composite" rods containing small tungsten carbide particles.

The inserts are set back a little from the cutting edge to allow for sharpening. The bit is now ready for the hard-facing operations. Composite rods or, in this case, tube rods—strong steel tubes containing crushed and screened tungsten carbide particles — are used for hard-facing. The entire area over the inserts is covered with this material.

Hard-setting and facing the cutting edges impart long drilling life. Next the reaming edges are hard-faced so that the bit will drill a full size hole. After the bit has been ground sharp, it is ready for use.

Hard Facing Rotary Drills

Noland J. Clark* has recently described the development of oil well drilling bits to cut rock formations. Churn type drills were used in the first oil fields in the East. With the increasing demand for petroleum, the rotary drill was developed with a fish tail bit made from forged steel, and from this was evolved the modern rock bit used on a similar drill stem.

At present practically all oil prospecting is done with rotary drilling tools. The softer formations — clay, shale and some soft rock can be cut to advantage with fish tail bits, but harder formations require bits which do not take so much shock and will stand higher pressures than the fish tail. To meet this demand, the rotary rock bit has been developed.

This bit, making use of the same scraping action as the fish tail, combines other actions which permit the

*Assistant Chief Metallurgist, Reed Roller Bit Co., Houston, Tex.—This section is a brief of the author's article in the December 1938 issue of "Foote Prints" published by Foote Mineral Co., Philadelphia, Pa.

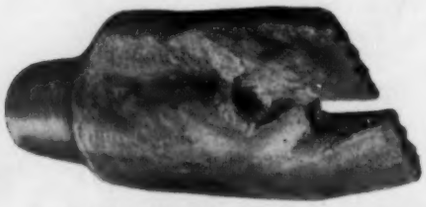
cutting edges to be multiplied by a number of teeth on a cylindrical or tapered cutter. This cutter is free to turn on its axis and thereby relieves to some extent the strain that each cutting edge is called upon to bear.

However, the teeth are pressed down in the formation, resulting in high abrasion of the cutting surfaces of each bit. This abrasive action calls for the hardest of materials. The first roller type bits were made of carburized steel, representing, as it did, the maximum hardness for steels backed up with a soft core for toughness. This combination of properties—maximum hardness or abrasion resistance and maximum toughness—are two properties difficult to accomplish at the same time in steel. Carburized steel to some extent met these problems but research has developed harder and more abrasion-resisting materials.

Cemented Tungsten Carbides

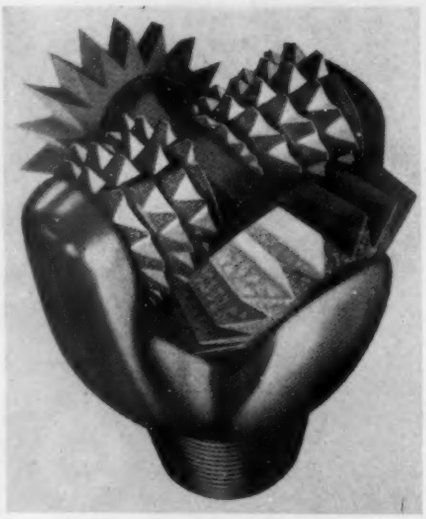
Welding presented a method of increasing the wear resistance of surfaces and a number of combinations of alloys were used over a period of time. Manganese, chromium, molybdenum, cobalt and tungsten were favorite alloying elements for these surfacing materials. Carbides, borides and nitrides all offered some promise. Difficulty was experienced in making welded surfaces of most of these alloys that would have uniform properties.

Work done in European countries and finally in this country led to the development of cemented tungsten carbides bonded by a tough material such as cobalt. This indicated the possibility of using the hard, brittle carbide of tungsten in a tough binder which would have some of the properties of each. The process of making these cemented carbides is very expensive and their attachment to cutting tools can be accomplished only by brazing. For these reasons their use in oil well tools has been quite limited.



Fish tail bit illustrating fingering action of tungsten carbide inserts when drilling.

How the fish tail bit appears after it has been rebuilt by oxy-acetylene hard-facing operation.



Rock bit cutters showing location of welded tungsten carbide on faces of teeth.

Ultimately fine grain tungsten carbide powder was applied directly to the cutting surfaces of bits. This was first accomplished by puddling-up the base metal of the bit with a carbon arc so that it surrounded the tungsten carbide particles, thus producing a surface containing a large number of small particles of tungsten carbide. A number of other methods have been developed for accomplishing the same result. It has been found by judicious additions to the steel and regulating the methods of heating, that the overall properties of the hard-face overlay may be controlled to a certain extent. Tungsten carbide of various grain sizes can now be applied by either electric or oxy-acetylene methods of welding. In all cases the overlay consists of a matrix of some ferrous alloys, either sweated-up from the base metal, or added in the form of a thin wall tube, which filled with the carbide particles is melted down around the grains.

Tungsten carbide is made from tungsten powder and carbon in an electric furnace and consists of a mixture of several carbides of tungsten. Economical methods of making it have been developed which yield a fine grain metal that has a maximum of ductility. The cast button is crushed to the screen size best suited for the purpose and results in sharp-edged, irregular grains. The steel binder used to cement the grains to the base metal, alloys with the carbide to such an extent that a strong bond results.

Fish Tail Drilling Bits

By the above methods tungsten carbide can be applied to all of the surfaces of rock bits used for drilling hard formations. Even the fish tail bit has been rebuilt to take tungsten carbide. The same granular carbides are used on the faces of these bits and a certain reinforcing of the cutting edge is accomplished by inserted tungsten carbide "fingers" extending downward from the cutting edge. The effect of these on drilling can be clearly seen in the fingering wear.

The cuttings made by all bits in the rotary class are removed from the hole by forcing an aqueous fluid down the hollow drill stem and up the outside between the drill stem and the wall of the hole. This fluid carries a great amount of slush which is often quite abrasive. Tungsten carbide and alloys containing them have been used to advantage where this slush causes severe wear in restricted areas such as the slush tubes in bits.

It is possible to cast tungsten carbide in tubes or liners of a wide variety of shapes. Many of these special shapes are made from tungsten carbides that have some metal such as cobalt added for the purpose of decreasing their brittleness. This, however, lowers the over-all hardness.

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THE PUBLIC SERVICE GAS CO., of Minneapolis, Minn., has filed an application with the Federal Power Commission for permission to construct a welded natural gas line from Montana and Wyoming to North Dakota, South Dakota, Minnesota and Wisconsin, a distance of approximately 1,500 miles.

» «

Plans have been completed for the construction of a 100-mile 16-in. welded pipeline by MENE GRANDE OIL CO., a Gulf Refining Co. subsidiary, in eastern Venezuela. The line will run from the new Oficina field, in eastern Venezuela to Guanta, on the Caribbean Sea.

» «

A WELDED STEEL FRAME GARAGE and warehouse at 3625 Long Beach Boul., Long Beach, Calif., will be built by The Austin Co., of Los Angeles. The structure is being erected for SCHLUMBERGER WELL SURVEYING CO.

» «

THE SOUTHERN CALIFORNIA TELEPHONE Co. plans the early construction of an all-welded 3-story structural steel building at 11th Ave. and Vernon St., Los Angeles. Bethlehem Steel Co. was awarded contract for the material.

Brief Sketches of Welding Jobs

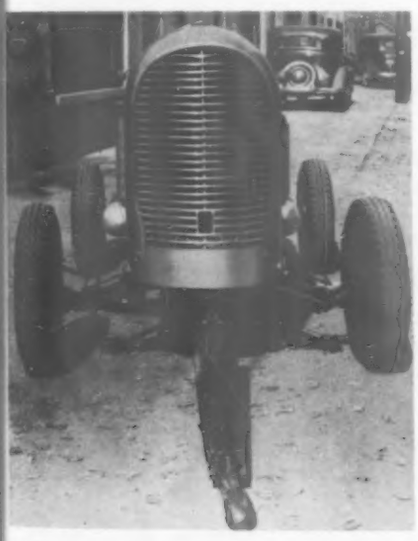
"Streamlined" Portable Welder an Effective Advertising Medium

By A. F. DILLON

★ That everlasting urge to produce something different and better seems to be a powerful force. If it was not for this urge driving the manufacturers forward I guess we would still be riding horseback, and bucking wood, instead of enjoying the comforts and conveniences we have today. I have been connected with welding for some 27 years and have had an opportunity to see it grow to a well established and important business.

I guess everyone has a "pipe dream" or brain storm once in a while. Well, that was the case here. I looked over the gas engine arc welders now on the market, and they looked and operated just the same as they did ten years ago. Well, the urge to have something different just could not be stopped, so without drawings, prints or measurements, I collected an engine, an arc welding generator, and an armload of steel, sprockets, chains, and tools, and proceeded to complete my "pipe dream." It took some time, but after it started to take form, it was not such a tough job to produce the completed machine.

A feature of Mr. Dillon's unit is his method of handling welding cables on power-driven reels.



Front end of unit presents a "snappy" appearance.

With the exception of the two side panels, the machine was constructed in our shop. The grill was made up of ½ in. cold rolled steel, shaped, and welded. The radiator was designed for a much larger engine than is used in the welder thus giving ample cooling area, and preventing overheating. The gas tank is tucked under the hood, and below that is the governor which rests on the head of the engine.

The battery, which is the long narrow type, sets on the inside of a 6 in. channel which comprises the base for the motor, generator, cable reels, and cylinders. The generator is closely coupled to the motor, and possesses a device which controls the welding current at any distance. Below the generator operating panel is the motor control panel, which is wired for lighting the inside of the machine.

Turning to the next compartment, the reader will see my system of eliminating that everlasting trouble of handling cables, when starting a welding job, or when the job is finished. I know from experience what it means to drag two or three hundred feet of cable in to a job and park it away again when I am tired out.

The cables are on separate reels; the holder cable is on the first reel, and the ground cable, on the second. Each reel has a large thin sprocket bolted to it. Each sprocket is driven from the jackshaft and this jackshaft is operated by two separate electric motors, which are fitted to a bracket on the chassis. When I am ready to go home all I have to do is to snap the switch and the cables roll up neatly.

The welding rods for oxy-acetylene are carried in tubes under the reels, and are carried in the base of the machine. An acetylene cylinder is fastened to the cable reel bracket, and the torches, fluxes, and small materials are in the top of the back door, which also holds the helmet, clothing, and extension cord. Two cylinders of oxygen are carried in the tubes on the sides of the machine.

The cost of the "streamlined" portable machine over and above the price of the usual home-made welder can be charged up to advertising. We have never regretted the extra expense, because we have had a tremendous amount of interest aroused wherever the machine is working.

A streamlined portable unit such as this one does an excellent advertising job.

» «

Hard-Facing of Scarafier Tooth

★ Hardening a scarifier tooth used in county road work is a repeat job which Loy Fixen —Grants Pass, Oregon, welder—finds profitable. The point wears off in two months of road grading work, or in two weeks when used in a gravel pit. About ½ lb. of Stoodite is used to reinforce the point, for which $3.50, $4.50 or $5 is charged, depending upon condition of the tooth.

The scarifier is employed to loosen dirt and gravel for a bulldozer blade, to the rear side of which it is attached. The tooth swings on a pin at the upper end, therefore drags behind, while the bulldozer blade is working. To use the scarifier, the machine is run in reverse, causing the blade to push the tooth backward and dig into soil or gravel. The bulldozer is then moved forward, one end of the blade getting a "bite" in the material loosened by the scarafier.

The scarafier tooth is a steel bar 4 in. square and 34 in. long, with lower end pointed and curved back. It swings on a 1½ in. steel pin supported at either end by 1½ in. steel plates, 5 in. square, welded to the bulldozer at right angles. It was found necessary to reinforce the blade on both sides with ⅝ in. steel plates where the tooth is attached.

The scarafier is sharpened by welding onto the point a piece of steel 1 in. x 4 in. x

This scarifier tooth has been hard-faced using about ½ lb. of Stoodite.

4 in. and covering the end and lower side of the latter with approximately ½ lb. of hard-facing metal. An important point in this operation is to weld the square piece of steel against the round point of the tooth, instead of first flattening the latter. If this were done the new point would be held in place only by a welded band around the outside of the joint, while when a square face is welded to a curved one, the entire area of both surfaces are fused together, forming the strongest possible union.

» «

An Unusual Welder's Hobby

★ F. F. Nichols of David City, is a welder and a good one. During the summer he has little time for hobbies, but in the winter months, he takes a hand in some unusual creative work of his own. Mr. Nichols takes up his oxy-acetylene blowpipe, some steel welding rods and some bronze ones, a few additional light sheets of steel, and sets to work fashioning small metal figures depicting life and action in the Old West. The hands and equipment that shape them are the same that each year repair and fabricate tons of heavy industrial equipment.

The solid body portions are built up with a melted steel rod and then given a lustrous coating of bronze with the bronze welding rod. Exact blowpipe control of the direction of the intensely hot flame, and skillful manipulation of the welding rod makes possible the careful shaping of each figure. The patina, or surface color of the bronze coating, is obtained by varying the flame to get different effects of shading.

Figures in Mr. Nichols' composite groups are made up separately. For instance, in mounted groups the horsemen, saddles, and horses are welded to shape separately, and then joined together by welding. As can be seen, Mr. Nichols is inspired by scenes from the colorful Old West that is now vanishing.

F. F. Nichols enjoys unique distinction of being a welder - artist. Shown at work in his shop.

Simple wood-burning stove made by salvaging used oil drum. Welder sells this stove for $5.

Welded Stoves Made from Steel Drums

★ During the past seven or eight years Loy Fixen, Grants Pass, Ore., a welder, has made about 250 wood heating stoves out of used steel drums. For this job he charges $3.75, mostly for labor and profit, since the material used is largely scrap iron. A common steel arc welding rod is employed for fastening equipment in place and an oxy-acetylene torch for cutting openings in material. The drums generally are 55-gal. lubricating oil containers costing about $1.25 to $1.50, making the total price of the stove $5 to $5.25.

These welded steel heaters are considered worth more than stoves sold in stores for two or three times this amount, because made of better metal and burning larger chunks of wood. They are used in workshops of various kinds, bulb-sheds and greenhouses, mine and logging-camps, hunting and fishing lodges and other similar places.

No set pattern is followed in converting an oil barrel into a heating stove, each job being adapted to the customer's requirements and material available. The welder has a good chance to exercise his ingenuity. For legs, Mr. Fixen has used a quantity of channel iron originally employed to reinforce baker's cooking-fat drums. A steel hoop is cut in two and the halves welded lengthwise to each side of a drum just below the bulge. Small rods are then run from the end of each leg to the lower side of the barrel, as shown in the photograph.

Old ¾ in. water pipe is sometimes utilized for legs, a 3 ft. piece being bent under each end of the drum, then turned down at each end for legs. Brace-rods are run from legs to side of barrel. Sometimes, where stove space is limited, the drum is used vertically, one end resting upon the floor and a smoke-pipe projecting from the upper end, near one side.

The door is cut out of 14-gauge metal, either round or square, although each has a straight side for two 3 in. butt or T hinges, which are welded in place. The pipe base is welded over a hole of suitable size cut in the upper side of a drum used for a horizontal stove, near the rear end. The diameter of the fuel opening is 1 in. less than the door, giving it ½ in. lap. The draft door is a round piece of sheet metal 6 in. in diameter, with three 2 in. triangular holes fitting over holes of similar size cut in the door and fastened in the center with a screw bolt, on which it is turned by a handle welded onto one side.

The door-latch is made of a 6 in. piece of 1 in. strap-iron bolted at one end and dropping into a notch cut into a 4 in. strap bent into a right angle and welded near the door's edge. The latch works up and down in a slot formed by welding a strap vertically onto the door. A vertical stove does not, of course, need a door-latch.

Sometimes another drum of similar size, or smaller, is placed above the firebox for a hot air chamber, supported by a 3 ft. piece of 1 in. strap iron at either end, bent under the upper barrel and turned down 6 in. at the ends, which are welded onto the drum beneath. A short section of stove-pipe connects the two barrels at the front, while smoke escapes through a pipe resting over a hole at the rear end of the top drum.

A great many variations may be made in the foregoing plans and various attachments built onto steel drum stoves. Mr. Fixen obtains hot water in his shop by welding onto his two-drum stove a 30 in. x 8 in. tank made of 14-gauge metal, placing this container on top of the firebox, between two legs of the upper drum. Water is poured into the tank through a 1 in. pipe with a funnel at the top.

Brief Sketches of Welding Jobs

Welded Pipe Joints Unbroken

★ The resistance of properly welded pipe joints to breaking was well illustrated by an instance during last September's New England hurricane. A long 3-in. pipeline with welded joints and containing a 20-ft. expansion loop was supported 20 ft. above ground and supplied process steam to an important chemical manufacturing building. The hurricane toppled a number of its supporting

This steam line with welded joints fell but was not broken when its supporting posts were toppled by the hurricane. (Photo ("Factory Mutual Record," 184 High St., Boston, Mass.)

posts, and a long section of the pipeline and its supporting structures fell, but the pipe did not break and was continued in service. Screw flange or coupling joints undoubtedly would have torn at the thread and caused the pipe to fail, thus necessitating a several-hour shutdown of important processes.

» «

New Steam-Electric Locomotive

★ A new steam-electric locomotive (rated at 5000 hp.) just completed by General Electric for the Union Pacific Railroad is said to be the first of its kind in the world embodying a condensing high-pressure turbine. It is claimed to be capable of doing twice the work of the conventional type of steam locomotive for the same amount of fuel. It is further claimed that it will travel three times as far without stopping for fuel or water. Heavy transcontinental trains, up to 12 standard Pullman cars, can be hauled at speeds up to 125 m.p.h. Cost of the new steam-electric locomotive is said to approximate that of the diesel-electric type.

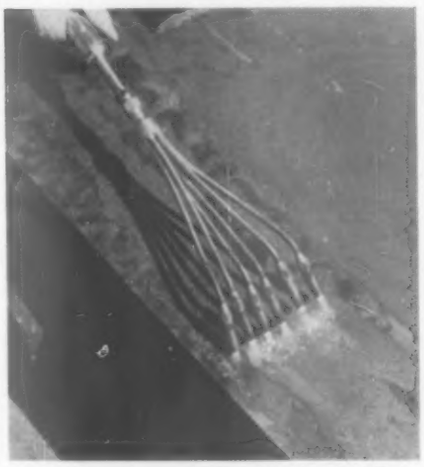
The cab utilizes the lightest possible construction consistent with requirements of strength and rigidity. Its frame is built up with high-strength steel tubular members. Aluminum sheets sheath the cab, except for the streamlined nose, which is of steel welded throughout. Welding was largely used in fabrication of the new locomotive, except for the aluminum sheets, which were riveted.

» «

Application of Oxy-Acetylene Multi-Flame Descaling Torch

★ A manufacturer of road grading equipment was having difficulty in removing scale from steel channels. His principal complaint was the peeling off of paint with the scale after the equipment had been in service for several months. This company had tried several ways to remove scale, using wire brush, hammer and chisel, hand brush and hammering. With these methods only part of the scale could be removed and customers still complained about the chipping off of paint.

The Airco service engineer in this territory submitted a new type of multi-flame descaling torch to the manufacturer and asked for an opportunity to demonstrate what it could do. In this test all scale was successfully removed from the steel channels. The



This multi-flame descaling torch will remove heavy scale from steel plates and rolled sections. Photo (Air Reduction Sales Co.).

service engineer was then asked if the same torch and tips could be used for removing scale from ½-in. plate which had been stored in the yard for several years. The descaling equipment was then moved to the yard and a successful demonstration carried out on ½-in. plate. An illustration shows this torch in operation removing scale from ½-in. plate.

In his inspection of the plant the service

Removing scale from ½-in. plate, using new type of multi-flame torch. Photo (Air Reduction Sales Co.).

engineer found several men removing paint from graders which had been in the yard about a year. These men were using a scraping tool and a wire brush. He suggested use of the descaling tip for removal of paint. This was tried, and it was found possible to remove more paint in 30 min. than two men could remove in a half day. These operations have become standard at this plant, and this tip is now in use from three to five hours each day.

Following is a summary of operating data based on two sizes of rolled channels:

(1) Size 7 in. x 2½ in. x 15 ft., 6 in. (one side only):

Area descaled on each channel	15.50 sq. ft.
No. of passes	3
Area per minute descaled	1.55 sq. ft.
Acetylene per sq. ft. descaled	0.645 cu. ft.
Oxygen per sq. ft. descaled	0.970 cu. ft.

(2) Size 10 in. x 2½ in. x 20 ft. 10 in. (one side only).

Area descaled on each channel	26.00 sq. ft.
No. of passes	4
Area per minute descaled	1.04 sq. ft.
Acetylene per sq. ft. descaled	1.35 cu. ft.
Oxygen per sq. ft. descaled	1.92 cu. ft.

Equipment used: Airco descaling tips (6 tips with 5 flames each) No. 70 drill size. Style 9800 torch. Acetylene pressure 10 psi. and oxygen pressure 12 psi.

» «

Bronze Welding Saves a 4200-Lb. Gray Iron Rock Crusher Casting

★ A 4200-lb. rock crusher casting was broken completely off on one side and within four inches of being completely cracked through

Welding helped to build this revolutionary type of steam-electric locomotive.

Fig. 1—Preparation of crack in 4200-lb. rock crusher casting before repaired by bronze welding. Photo (Air Reduction Sales Co.).

on the other side. In addition two ribs inside the casting were broken along the cylinder wall. This crack extended clear through the cylinder wall in one place.

The illustration above shows the operator working, but shows the crack on the opposite side after it had been vee'd out with a chipping hammer. This crack extended the full length of the casting on this side. Figure 2 illustrates the completed welding job. Both of the bronze welds between the two ribs and the cylinder wall are visible.

It was decided that preheating in a charcoal fire would be impractical because the casting was difficult to handle for welding. Moving the casting into different positions would cause some distortion, it was thought. The two ribs were welded first, the casting then being set on the opposite end from that shown in Fig. 2. Part of the welds on the ribs which show in the picture, were completed after the casting was turned over to the position shown in Fig. 2.

Two torches were used while welding the ribs, an operator working on each side and building up in a vertical position, one rib at a time. Since the outer part of the casting was cracked clear through, it was possible to get heat expansion while welding the ribs, and when this part had cooled, the outer part went back into its original position.

Part of the welding on the outside was done with two torches, but one torch was also used for preheating part of the time. The total length of the cracks measured between 12 and 13 ft. The cylinder was checked up after the casting had cooled off, and was found to be a few thousandths inch out of round. It was bored out and a new bushing put in.

Preparing, chipping and other preliminary work took 21½ hrs., and welding time, two men, 28 hrs. Two torches were used for welding and preheating most of the time. Airco-DB tips 9, 10 and 12 being used. Oxygen and acetylene consumption were 1940 cu. ft. each, while 124 lbs. of Airco ¼-in. No. 20 bronze rod were deposited with 3 lbs. of Marvel flux. Total cost to the customer of the work done on the casting was between $300 and $400. Cost of a new casting is about $850.

Fig. 2—Another view of casting after it was bronze welded. Photo (Air Reduction Sales Co.).

» «

Motor Shaft Extended By Bronze Welding

★ The extension of small electric motor shafts, without removing the rotor, is an operation that is frequently desired. A service shop which has been doing this type of work for several years has developed a particularly satisfactory method by the use of bronze-welding. Experience has shown that ordinary steel welding is not satisfactory because of scaling which reduces the journal diameter several thousandths of an inch.

Most motors run in bronze bearings, and it is normally not good practice to run moving parts in bearings of the same metal. It has been found, however, that bronze-welding rod is well suited to the job. The deposited bronze makes a perfect joint and is hard and tough enough to wear well against either bushing bronze or the so-called pot-metal alloys. In addition, the welding rod can be applied at a temperature low enough to prevent scaling.

The accompanying sketches clearly illustrate the method used for extending motor shafts. The end of the shaft to be lengthened is first tapered and drilled just large enough to take a small pilot. A piece of cold-rolled steel 1/16 to ⅛ in. larger in diameter than the desired finished size is then turned on one end and pressed into the shaft. This serves to line-up the work which is now ready to be welded.

The shaft is chucked and trued with an indicator or tied back on the center, the welded end being run in the steady rest just back of the weld. Bronze welding rod is then applied. After welding, it has been found advisable to release whatever stresses may exist, by first taking a roughing cut over the joint, then recentering and refinishing.

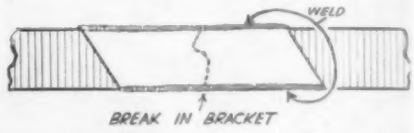
The cost of this method is about one-third to one-half of what it would ordinarily cost to machine and install a new shaft. From every angle it has proved to be a good way to lengthen electric motor shafts.

Some Suggestions For Welding Reinforcing Straps

By T. C. SEVERTS

★ In my calls on job welding shops I have noticed reinforced bumper brackets, frame cross members, etc., brought in to be re-welded, because the operator "slipped up" in applying the reinforcement. Probably the two most common causes of such failures are (1) cutting off the reinforcing strap so that it is square across the end and (2) welding the strap across the end.

I recommend the following procedure on bumper brackets: Carefully vee out the broken ends, line them up and tack weld. Then with a 5/32 in. electrode and about 140 amp., the operator should complete the weld. The next step is to cut a steel strap ¼ in. thick and slightly narrower than the



Improved design of reinforcing strap.

bracket. This strap should then be clamped to the bracket and welded along the top and bottom edges. It is important to cut the reinforcing strap with diagonal ends as shown in the sketch. This can be done easily with an oxy-acetylene cutting torch.

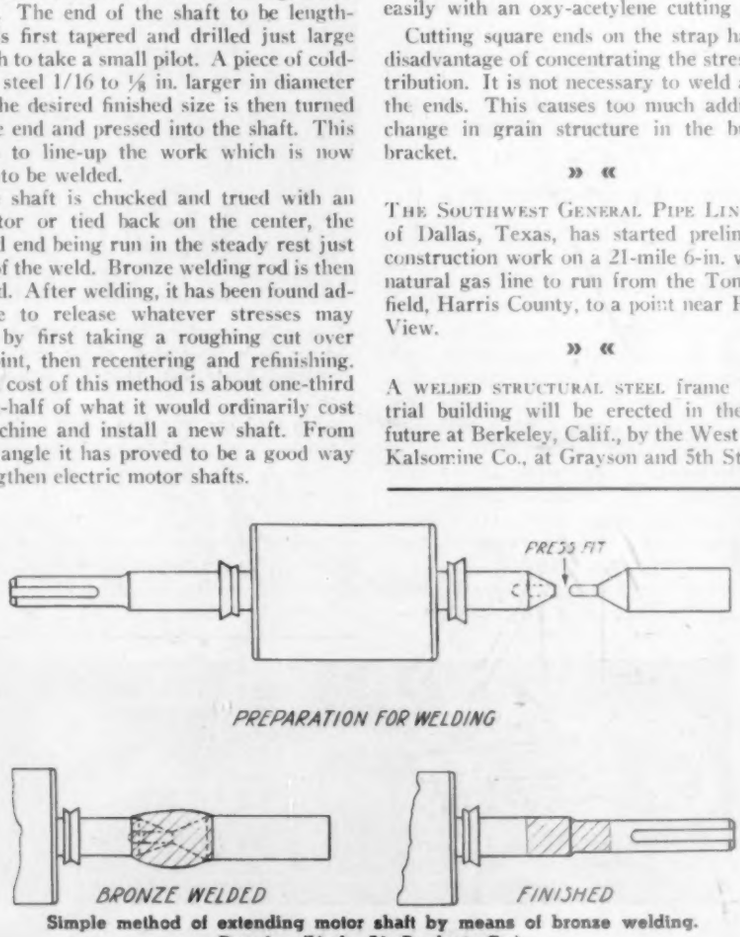
Cutting square ends on the strap has the disadvantage of concentrating the stress distribution. It is not necessary to weld across the ends. This causes too much additional change in grain structure in the bumper bracket.

» «

THE SOUTHWEST GENERAL PIPE LINE CO., of Dallas, Texas, has started preliminary construction work on a 21-mile 6-in. welded natural gas line to run from the Tom Ball field, Harris County, to a point near Prairie View.

» «

A WELDED STRUCTURAL STEEL frame industrial building will be erected in the near future at Berkeley, Calif., by the West Coast Kalsomine Co., at Grayson and 5th Sts.

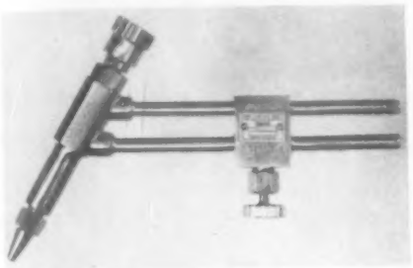


Simple method of extending motor shaft by means of bronze welding. Drawing (Linde Air Products Co.).

New Product Developments

Lead Burning Blowpipe

★ A new blowpipe is now available which, because of its wide range, and because it operates with either oxygen and acetylene or oxygen and city gas, is suitable for all classes of lead welding operations and also for automobile radiator soldering. It is known as the Oxweld Type W-30 lead burning blowpipe.



Type W-30 blowpipe for lead burning operations.

The W-30 blowpipe has the lightness and ease of manipulation that are essential for efficient lead burning operations. It weighs only 7½ oz. and is 6 in. long. The injector in the head of the W-30 can be adjusted for all different sizes of tips by a turn of the extruded brass adjustment wheel. Should the blowpipe be dropped accidentally, this wheel, which fits closely over a round packing unit, minimizes the chances of damaging the valve stem. The W-30 produces a soft flame, without any tendency to "blow," which can be adjusted to an intense needle point or to a long brush.

Further information regarding this blowpipe can be obtained from the nearest office of The Linde Air Products Co.

» «

Wilco Type J A-C. Welder

★ A new transformer type a-c. welder employing inductive reactance for welding current control has been introduced by Wilco Electric Welders, 446 State Ave., Kansas City, Kan. This newly developed model is known as the Type J Challenger a-c. welder. Among the claims advanced for this model are: Ability to operate on as low a current as 10 amp. without spatter loss; ability to maintain a long or short arc steadily on the low heat stage; ability to run beads on 26 gauge material without burning through. It is stated that the welding arc operates with little or no spatter loss over the entire heat range.

Welding with stainless steel electrodes can be done equally as well as with regular mild steel electrodes it is claimed. Using a carbon pencil as an electrode it is possible to use the unit for soldering work.

The Type J welder is designed to meet the requirements of sheet metal shops, body builders, light manufacturing, plumbers, garages, machine shops, or any application where the amperage range (10 to 100) will justify using from 1/16 in. to 5/32 electrodes.

The cabinet design is insulated with conventional type of insulation together with fibre covering, neatly trimmed with aluminum bindings, nickel-plated handles and is mounted on four casters. Furnished complete with cables, holder, helmet, and a supply of electrodes.

Operates on 110 to 220 volts, 60-cycle single-phase. Has 8 heat changes. Cabinet size overall: Height 17 in., width 16 in., length 22 in., weight 185 lbs.

Wilco Type J a-c. transformer welder has current range from 10 to 100 amp.

» «

New Portable Acetylene Flare Lights

★ The Alexander Milburn Co., 1493 West Baltimore St., Baltimore, Md., announces three new portable flare lights. These flares are designed to be used by contractors, welders, railroads, street railways and all industries working out-doors at night. They are furnished in three sizes:

(No. 10T) For use with Type MC, 10 cu. ft. Prest-O-Lite acetylene tanks. Equipped with 10 in. aluminum reflector, tank connection, swing joint and stand pipe. Height of attachment 12 in. to center of burner; overall height, including tanks, 30 in.

Three types of portable flare lights.

(No. 40T) For use with Type B, 40 cu. ft. Prest-O-Lite acetylene tanks or tanks of similar size. Equipped with 13 in. aluminum or porcelain reflector, tank connection, swing joint and stand pipe. Height of attachment 18 in. to center of burner; overall height, including tank, 40 in.

(No. 150T) For use with standard 150 cu. ft. or larger, acetylene tanks. Equipped with 13 in. aluminum or porcelain reflector, tank connection, swing joint, gas cutoff cock and stand pipe. Height of attachment to center of burner 28 in.; overall height when used with standard 150 cu. ft. acetylene tank, 66 in.

» «

Welder's Chipping Hammer

★ A drop forged and tempered chipping hammer has been placed on the market by the Wiese Company, Perry, Iowa, for distribution through welding equipment jobbers. This hammer weighs less than a pound, has a 6½ in. head and an overall length of 12¾ in. Small cavities can be cleaned easily by using the pointed end and flat surface welds can be cleaned by using the chisel-shaped end of the hammer.

Welder's chipping hammer.

» «

Dust Control Unit For Welding Shops

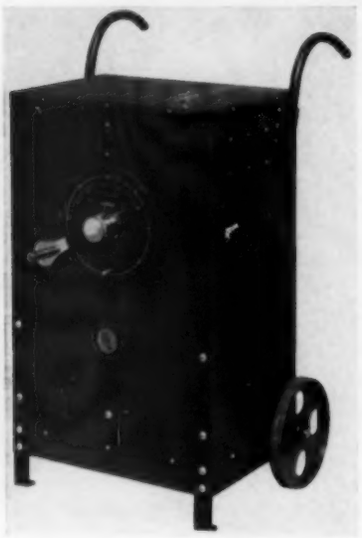
★ Falstrom Company, Passaic, N. J., has developed a unit type dust collector known as "Dustrol" for application in welding shops to remove fumes. It is stated that Dustrol is a complete self-contained unit for collecting, separating and filtering dusts. Flexibility is featured, because the unit is operated only when welding operations are in process, thus reducing the electric power costs. The unit is placed near the welding operator and under his control.

» «

Twentieth Century A-C. Arc Welder

★ A simple transformer-type a-c. arc welder, designated as the "All-In-One" welder, has been developed by the Twentieth Century Manufacturing Co., 6 East 27th St., Minneapolis, Minn. As noted in the illustration, the welder is made portable by mounting on two small wheels. The unit can be moved around the shop just as easily as a small hand truck.

A feature of this welder is the regulator handle and instruction dial mounted on the front of the unit. It is claimed that this enables the operator to become proficient in the use of the unit with a minimum amount of



A-C. transformer type arc welder.

experience. The instruction dial is designed particularly to help the man who has had little or no experience in arc welding. The Twentieth Century a-c. arc welder is rated at 200 amps. and is said to be capable of handling up to a 3/16 in. electrode. Primary circuit is designed for 220 volt, a-c. supply. Has the Underwriters' Laboratories label of approval.

» «

Twinweld Oxy-Acetylene Welding Hose

★ Hewitt Rubber Corp., Buffalo, N. Y., announces its Twinweld welding hose. This new hose consists of two lines of unusually flexible, cord-reinforced welding hose, formed into a single unit by a 22-ft. multiple-cavity mold at a temperature of 290 deg.

It is said that the new hose will not writhe nor twist under high pressure. Any differential of pressure in one line has no effect on its companion line. The individual passages have an inner lining of non-blooming gas-resisting compound that is cord reinforced. The carcass is extra strong and will successfully resist pressures many times greater than those incident to welding service, it is claimed.

The acetylene line has a bright red cover, the oxygen line a bright green one. To install the hose, a sharp knife is used to split along the joint line at each end a sufficient distance to form a convenient "Y" at both torch and tank ends. After this separation has been made, the ferrules, furnished with the hose, are crimped to prevent any further separation. Twinweld hose is available in any desired cut length, or in continuous lengths up to 500 ft. which can be cut as needed.

To install hose, a sharp knife is used to split along the joint.

» «

Clear-Vision Face Shield

★ Willson Products, Inc., 274 Thorn St., Reading, Pa., announces a new Protecto-Shield for guarding faces of workers in light grinding operations, wood working, spot welding and other occupations where protection is desirable. The Protecto-Shield permits clear vision in all directions. It is made of thick transparent cellulose acetate, is well ventilated and large enough to fit comfortably over correction spectacles. The shield extends well back along the sides of the face, and is easily thrown back when not in use. A special knitted sweat pad provides operator comfort. The adjustable molded rubber headband and all other parts are easily replaceable. Shield may be had in clear, amber, or green transparent cellulose.

The Protecto-shield gives the wearer clear vision in all directions.

» «

Syncro-Break Welding Contactor

★ The new Syncro-Break contactor is an interrupter which, in itself, opens the power circuit of a welding machine without drawing an arc at its contact tips. Although magnetic contactors were previously designed for long mechanical life, the heat dissipated at the arc, drawn at the conclusion of each operation, has always been a limiting factor in application. By eliminating this arc, the ratings which may be applied are materially increased and contact tip life is prolonged.

A small rheostat on the contactor provides a wide range of adjustment for contactor break point. Any tendency for the arc to re-strike after the tips have parted is overcome by the addition of a condenser connected in parallel with the load and by the use of special copper alloy contact tips. Further information regarding the Syncro-Break contactor will gladly be furnished by the manufacturer, Square D Company, Industrial Controller Division, 710 So. Third St., Milwaukee, Wis.

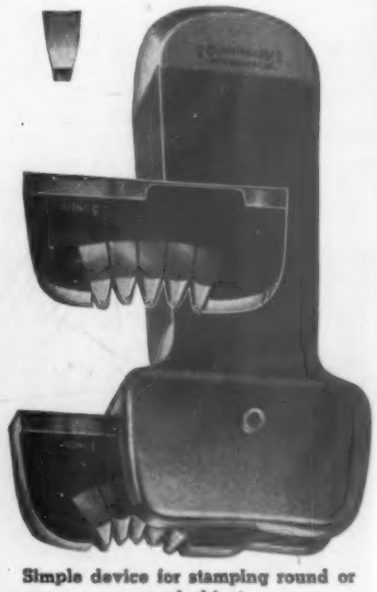
Welding contactor has non-arcing contacts.

» «

Wedge Grip Radius Holder

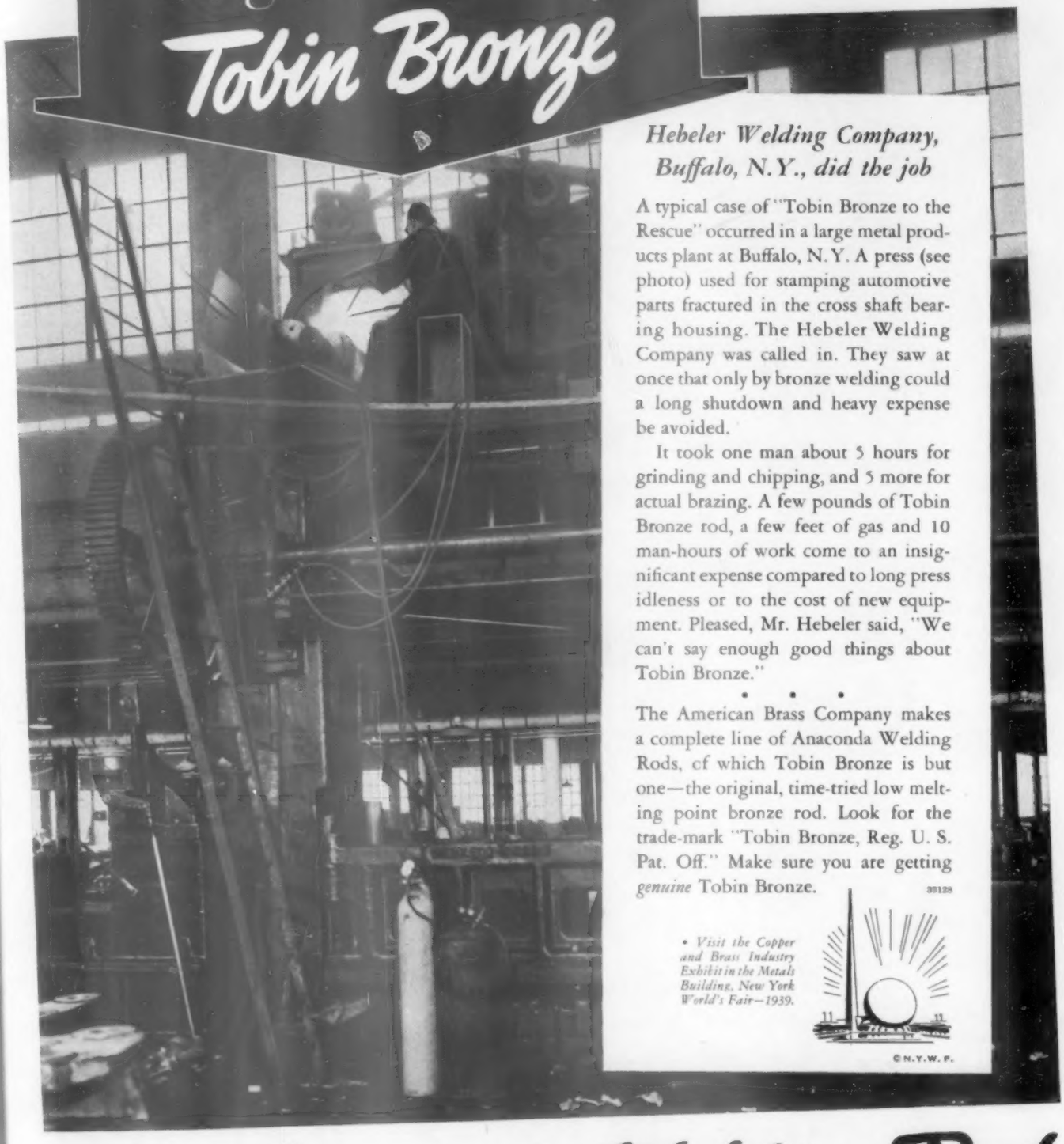
★ The M. E. Cunningham Co., 180 East Carson St., Pittsburgh, Pa., has recently introduced a new Wedge Grip Radius Holder employing interchangeable gear-tooth-shaped type for stamping round or curved objects such as pipe, shafts, gear blanks, forgings, etc.

Instead of straight tapered type, with limited radius, the gear-tooth type can be used on any radius, by adopting correct slide for whatever radius is to be stamped. In other words, only one set of type and holder is required for various sized slides. The manufacturer will send complete information, literature and prices upon request.



Simple device for stamping round or curved objects.

Press saved from long idleness by *Tobin Bronze*



Hebeler Welding Company, Buffalo, N.Y., did the job

A typical case of "Tobin Bronze to the Rescue" occurred in a large metal products plant at Buffalo, N.Y. A press (see photo) used for stamping automotive parts fractured in the cross shaft bearing housing. The Hebeler Welding Company was called in. They saw at once that only by bronze welding could a long shutdown and heavy expense be avoided.

It took one man about 5 hours for grinding and chipping, and 5 more for actual brazing. A few pounds of Tobin Bronze rod, a few feet of gas and 10 man-hours of work come to an insignificant expense compared to long press idleness or to the cost of new equipment. Pleased, Mr. Hebeler said, "We can't say enough good things about Tobin Bronze."

• • •

The American Brass Company makes a complete line of Anaconda Welding Rods, of which Tobin Bronze is but one—the original, time-tried low melting point bronze rod. Look for the trade-mark "Tobin Bronze, Reg. U. S. Pat. Off." Make sure you are getting *genuine* Tobin Bronze. 39128

• *Visit the Copper and Brass Industry Exhibit in the Metals Building, New York World's Fair—1939.*

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Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • *Subsidiary of Anaconda Copper Mining Company*

News of the Industry

Welding Lectures at University of Minnesota

An advanced lecture course in welding problems was held during the 3-day period, February 9-11, at the Continuation Study Center, University of Minnesota, Minneapolis, Minn. This course was planned to meet the needs of engineers who desire knowledge of latest developments in welding methods. The course was built around five basic subjects: (1) metallurgy and metallography, (2) design, (3) procedures, (4) stress analysis, and (5) testing.

Thursday, February 9:

Manufacture of Steels and Commercial Shapes—Professor Thomas Joseph.
Structure and Micro-constituents of Steel —Dr. R. L. Dowdell.
Metallurgical Aspects of Welding—Professor Thomas Joseph.
Heat Treatment of Steels—Dr. R. L. Dowdell.
Round Table Discussion—Leader, T. P. Hughes.

Friday, February 10:

Contribution of Oxy-Acetylene Flame to Welded Structural Design — R. F. Flood.
Welding of Clad Metals—F. G. Flocke.
Weldability of Alloy Steels—Dr. M. A. Grossman.
Round Table Discussion—Leader, T. P. Hughes.
Institute Dinner — Toastmaster, S. C. Lind, Dean, Institute of Technology.

Saturday, February 11:

Welded Design—Leon C. Bibber.
Resistance Welding—E. W. Forkner.
Welded Design Costs—Leon C. Bibber.
Procedure Control in Welding—E. W. P. Smith.
Round Table Discussion—Leader, T. P. Hughes.

At the Institute dinner held Friday evening, February 10, K. L. Hansen, consulting engineer for Harnischfeger Corp., Milwaukee, Wis., reviewed the progress of welding since the discovery of arc welding nearly 50 years ago by a French engineer. For nearly 30 years no commercial application was made. Mr. Hansen then sketched developments in the industry up to the present day and pointed out some of the probable directions in which new technical developments will come. The new arc welding machines will be more foolproof and more simple in construction than those now on the market, he predicted.

» «

Advanced Welding Course Offered in Tri-Cities Area

Engineers, designers, architects, production managers, welding supervisors, foremen and operators from industrial concerns of Moline and Rock Island, Ill., and Davenport, Iowa, interested in welding, will have an opportunity of obtaining advanced instruction in the practical and theoretical aspects of arc welding during the week of March 6th. A special course in arc welding design and practice will be sponsored by the American Society for Metals and The Lincoln Electric Co. The course will run from Monday, March 6th to Friday, March 10th. Meetings will be held at the Rock Island Arsenal. The course will be under the direction of E. W. P. Smith, consulting engineer for Lincoln Electric Co.

The primary object of the 5-day course is to provide engineers and designers the opportunity of studying the redesign of products for arc welded construction. The course will include talks and demonstrations on welded design and construction and consultation service on welding engineering problems for those attending. A $5.00 registration fee will be charged.

» «

University of Oklahoma Welding Conference—The College of Engineering in collaboration with the University Extension Division, University of Oklahoma, Norman, Okla., will hold a two-day welding conference and lecture course March 9-10. There will be four technical sessions, dealing with welding and cutting technique, welding inspection and testing, welding costs, and welding and cutting applications. There will be exhibits of equipment for welding and cutting, together with practical shop demonstrations. For further information communicate with Wm. T. Tiffin, College of Engineering, University of Oklahoma, Norman, Okla.

» «

University of Washington Welding Conference—On March 2, the Mechanical Engineering Dept. will conduct a welding conference, the program running from 2 p.m. to 10:30 p.m. There will be equipment exhibits, motion pictures and technical papers. The conference will meet in the Mechanical Engineering buildings on the university campus, Seattle, Wash.

Future Meetings

March 2, 1939
University of Washington, Department of Mechanical Engineering, Seattle, Wash. Will hold a welding conference from 2 p.m. to 10:30 p.m., including exhibits, motion pictures, and papers on welding.

March 9-10, 1939
University of Oklahoma, College of Engineering, Norman, Okla. First annual welding conference and short course on welding. Four technical sessions, demonstrations and equipment exhibits.

March 21-23, 1939
Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa. Will hold 11th annual welding conference (dates fall on Tuesday, Wednesday, and Thursday).

May 3-5, 1939
American Institute of Electrical Engineers, 33 West 39th St., New York City.
Northeastern District Meeting at Springfield, Mass.

Personals

Dr. Dugald C. Jackson, professor emeritus of electrical engineering, Massachusetts Institute of Technology, has been awarded the 1938 Edison Medal of the American Institute of Electrical Engineers, the highest award in electrical engineering. The award was made to Doctor Jackson "for outstanding and inspiring leadership in engineering education and in the fields of generation and distribution of electric power." The presentation was made on the evening of Wednesday, January 25, during the annual winter convention of the Institute, at the Engineering Societies building, New York City.

» «

E. J. Brady has recently been appointed manager, Stainless and Alloy Electrode Division of The McKay Co., manufacturers of arc welding electrodes, with headquarters at York, Pa. This company has entered the alloy electrode field and Mr. Brady will have

E. J. BRADY

charge of research and production as well as sales. Mr. Brady was recently sales engineer for Hollup Corp., Chicago and prior to that connection was sales engineer for Jos. T. Ryerson & Son, Inc., Chicago.

» «

Adolph Frankel has been appointed sales manager of special products of the Westinghouse Lamp Division, Westinghouse Electric & Mfg. Co. Mr. Frankel will be responsible for sales of Sterilamps, electronic tubes, x-ray tubes, and all other products of the lamp division, except lamps. He will make his headquarters at the Bloomfield, N. J., plant.

» «

Robert A. Curry has been appointed welding engineer for Armco International Corp., Middletown, Ohio. This company handles export business for American Rolling Mills.

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IN a few minutes this National No. 612 cut eleven 3/16" plates into side members for fabricated Diesel engine beds. Let a National shape cutting machine reduce your fabricating costs too! A National representative will gladly talk over your cutting problems with you.

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Inc., and is export representative for Lincoln Electric Co. in South America and several other foreign countries. Mr. Curry was formerly welding engineer for Central Steel & Wire Co., Chicago. In that connection he was active in the development of flux coatings for electrodes and handled welding problems for customers. Previous to his connection with Central Steel & Wire Co., Mr. Curry was welding engineer for Chicago Steel & Wire Co.

» «

NEIL C. HURLEY, JR. has been elected a vice president of Independent Pneumatic Tool Co., Chicago. Mr. Hurley has been secretary of the company for the past four years. He joined the company in 1932 upon graduation from Notre Dame.

» «

WILLIAM KATZER, formerly superintendent of the Gar Wood body plants, and more recently superintendent of the Michigan Tank and Furnace Corp., has been appointed manager of sales for the Welding Equipment & Supply Co., 2720 East Grand Blvd., Detroit, Mich., in charge of the Ohio territory with headquarters at Columbus, Ohio.

» «

V. H. DIETERICH of Chicago has been elected a director of American Institute of Steel Construction, Inc., to serve until the next annual meeting of the Institute. Mr. Dieterich is vice-president in charge of operations of the Special Order Department of Joseph T. Ryerson & Son, Inc., a subsidiary of Inland Steel Co. He has direct charge of fabrication of structural steel.

» «

L. J. GALBREATH has been appointed technical adviser for Revere Copper & Brass, Inc., with headquarters at 75 E. 45th St., New York City. Mr. Galbreath will serve customers in the New York district sales territory.

» «

KEITH C. POWERS has been appointed sales representative for Western Missouri and State of Kansas for Revere Copper and Brass Inc. Mr. Bowers will have headquarters at 325 Ward Parkway, Kansas City, Mo.

» «

HENRY BOOTH, treasurer of the International Acetylene Association and sales manager of Shawinigan Products Corp., New York, has just recently been re-elected for the third consecutive term as president of the Chamber of Commerce of Westport, Conn.

Trade News

G. E. TO BUILD NEW CHICAGO HEADQUARTERS—77,000 sq. ft. of land has been purchased for the erection of a modern building to house the General Electric Co.'s Chicago headquarters. An expenditure of approximately $2,500,000 is involved in the project, of which about 20 per cent represents investment in land. The site occupies the block bounded by South Canal, South Clinton, West Cabrini and West Arthington Sts.

Work will soon be started on the building which will provide space for the General Electric sales offices, warehouse and service shop; the General Electric Supply Corp.; R. Cooper, Jr., Inc.; and other associated interests.

» «

THE C. AND W. PRODUCTS CO. has moved its plant from 5850 Forsythe St., to 2539 Woodward Ave., Detroit, Mich., to take care of increased business. FRANK E. WRAY is proprietor.

» «

CHARLES E. PHILLIPS, of C. E. Phillips & Co., Detroit, Mich., reports a noted improvement in business, which he attributes largely to the pick-up in the automobile industry, as well as other industrial lines.

» «

ROTH MFG. CO., Detroit, Mich., has been taken over by FEDERAL MACHINE AND WELDER CO. of Warren, Ohio. The plant of the Roth Co. at 17144 Mt. Elliott Ave., has been closed.

» «

EDGE MOOR IRON WORKS, INC., 30 Rockefeller Plaza, New York City, has appointed COCHRANE ENGINEERING CO., 53 West Jackson Boul., Chicago, as exclusive sales represenative for the sale of fabricated vessels and chemical equipment. The Chicago office is under direction of H. J. MEIER and THOMAS BISHOP.

» «

ARCOS CORP., Philadelphia, Pa., have appointed the DUCOMMUN METALS AND SUPPLY CO. of Los Angeles and San Francisco as California distributors. Ducommun are carrying warehouse stocks in Los Angeles and San Francisco from which West Coast users can obtain quick deliveries.

» «

YATES WELDING SUPPLY CO., Austin, Tex., is a newly organized distributor of welding equipment and supplies. This organization is headed by H. M. YATES who has long been associated as a sales representative for welding equipment manufacturers in the Texas territory.

» «

THE LINDE AIR PRODUCTS CO. announces that its laboratory formerly located at 169 Chandler St., Buffalo, N. Y., has been moved to a new location at East Park Drive and Woodward Ave., Tonawanda, N. Y.

» «

THE WIESE PLOW WELDING CO. (originally known as New Process Plow Welding Co.) Perry, Iowa, has appointed the O. K. I. WELDING SUPPLY CO., 342 Reading Road, Cincinnati, Ohio, as a distributor for Ohio, and for parts of Kentucky and Indiana.

» «

THE CHASE WELDING SUPPLY CO., Benton, Ill., has been appointed by Air Reduction Sales Co. as an authorized dealer in Airco oxygen and acetylene and Airco welding and cutting apparatus and supplies. In addition, Wilson electrodes and National carbide will be carried in stock. This new Airco dealer will serve customers in 20 counties in Southern Illinois.

» «

REVERE COPPER & BRASS INC., 230 Park Ave., New York City, announces completion of a $3,250,000 brass and copper mill at Rome, N. Y., as part of a modernization program. Much of the modernization program was carried out during a period of depressed business. "Heavy industry," said Mr. Dallas, president, "cannot modernize during a period of great business activity. The idea that heavy industry must stop all capital outlay and accept plant depreciation and equipment obsolescence in dull times is all wrong. When factories are running double and triple shifts and buyers are clamoring for deliveries and production executives are over-worked trying to keep up with orders, factory schedules cannot be disrupted by dismantling old machines and installing new ones. Engineers and executives have no time to plan and supervise improvements and capital is fully employed financing the large volume of business."

Foreign News

HASSELT BRIDGE DISASTER—Since publication of the editorial in the December, 1938, issue by Harold S. Card on the subject "A Welded Bridge Ghost Story," we received the following comments from W. E. BENBOW, editor of "The Welding Industry," London, England:

"We had so many stories about the Hasselt bridge disaster that were not doing welding any good, that the Institute of Welding sent over a delegation to find out something about it. The actual delegates were engineers working for two prominent electrode manufacturers and by courtesy of the companies, the views of the delegation were published in The Welding Industry in July, 1938. The conclusions arrived at were 'there were no grounds whatever for contending that the collapse has been caused through embrittlement of the steel due to welding, or that welding as such can be held responsible for the failure'. It is not anticipated that the report of the special Belgian commission of inquiry will upset those general conclusions."

Current Reviews

HUDSON'S "ENGINEERS' MANUAL"—This is the Second Edition of the Engineers' Manual" published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $2.75. The author, RALPH G. HUDSON, is professor of electrical engineering at Massachusetts Institute of Technology. The book is based on the idea of giving a practicing engineer or student a handy reference book of pocket size, containing most of the formulas and constants used in his daily work. Applications of formulas are stressed rather than the process of derivation. This Second Edition contains engineering formulas, mathematical equations, and tables of constants all presented in systematic order in a book of such size as will fit easily into the pocket. It is essentially a formula book in highly condensed form and should prove to be helpful to designing engineers. Contains 335 pages and an alphabetical index.

» «

POWER FOR SINGLE-PHASE WELDERS—For several years motor-driven single-phase generators have been used for practically every type of resistance welding service. Using experience derived from performance of these generators as a basis, R. H. WRIGHT, of the Westinghouse Co., discussed correct

application of conversion equipment for future applications in resistance welding, before the recent A.I.E.E. winter convention in New York City.

The rated power factor of welding generators ranges from 30 per cent for spot welders to 60 or 70 per cent for butt and flash welders. For some applications it is desirable to operate more than one welder from a single generator. Two or more spot welders with electronic timers can be operated from a single generator of minimum capacity, if an electronic synchronizing device is used to permit only one welder to be energized at one time. Such an arrangement introduces no appreciable delay in production, since each welder in turn is locked out for only a fraction of a second.

Reprinted copies of the complete manuscript are available. Requests should be addressed to Westinghouse Editorial Service, East Pittsburgh, Pa.

» «

VOLUME ON CREEP DATA—Compiled by the Joint A.S.M.E.—A.S.T.M. Research Committee on Effect of Temperature on Properties of Metals and published by the two societies, this volume of 864 pages affords in convenient form important data on high-temperature creep characteristics of metals and alloys. The 486 sheets of test data, 273 graphs and 37 tables cover wrought steels and ferrous alloys, cast steels and ferrous alloys and non-ferrous materials.

Extensive tables give complete data on the large number of materials considered. There are charts of stress and corresponding creep rate for each type of material at each temperature; curves of temperature versus creep rate (0.10 per cent per 1000 hours) for each type of material wherever sufficient data were available; tabulated forms which give detailed descriptions of each material including its form, heat treatment, chemistry, hardness, grain size after the McQuaid-Ehn test, impact values, initial physical properties, manufacturing data, room temperature properties of specimens after creep tests, creep characteristics, and in so far as possible, photo-micrographs showing initial microstructure and micro-structures of completed creep specimens.

Copies of this publication can be obtained from either A.S.T.M., 260 S. Broad St., Philadelphia, Pa., or A.S.M.E., 29 West 39th St., New York City, at $12 each postpaid in the U. S. and Canada; elsewhere $14, postpaid.

» «

PROPOSED STANDARD FOR WELDING PIPE FITTINGS—A draft of a proposed American Standard for Welding Fittings has recently been completed by Subgroup No. 6 on Welding Fittings, of Subcommittee No. 3 on Steel Flanges and Flanged Fittings of Sectional Committee (B16) on the Standardization of Pipe Flanges and Flanged Fittings. This proposal covers the over-all dimensions of fittings as designed for butt-welded joints, such as elbows and tees, caps and lapped-joint stud ends, reducers, and return bends. It covers also the pressure ratings, size, marking, material, metal thickness, tolerance, and welding bevel. This proposal is now being distributed to industry for criticism and comment. Copies are available on application to C. B. LEPAGE, assistant secretary, The American Society of Mechanical Engineers, 29 West 39th St., New York City.

The standardization of welding fittings is a part of the project assigned to the Sectional Committee on the Standardization of Pipe Flanges and Fittings (B16) of which DR. COLLINS P. BLISS is chairman and J. J. HARMAN is secretary. The committee was organized under the procedure of the American Standards Association in 1921 with the Heating, Piping and Air Conditioning Contractors National Association, the Manufacturers Standardization Society of the Valve and Fittings Industry, and The American Society of Mechanical Engineers, as joint sponsors. In all, 30 national organizations including the A.W.S. are cooperating in this project.

"DESIGN OF INDUSTRIAL EXHAUST SYSTEMS"—This new book (220 pages) by John L. Alden tells the engineer how to design and build, or how to buy, an exhaust ventilating system. Although exhaust ventilation has been practiced for more than 70 years, and it has been recognized by statute for more than 40 years, the literature is said to be very scanty.

Mr. Alden's book covers the following subjects: Flow of fluids; hood forms; air flow through hoods; pipe resistance; piping design; dust separators; low-pressure conveyors; centrifugal exhaust fans; structural details and system planning; field measurements and their interpretation. The Industrial Press, 148 Lafayette St., New York City, is the publisher. Price is $3.00.

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Titan Manganese Bronze—is used where both hard and tough welds are desired. Although this is a general purpose rod, it is especially recommended for cast iron. It is free flowing and gives extremely dense, non-porous welds.

Titan Bronze—is a tin bronze with uses and characteristics similar to the manganese alloy; penetrates seams and crevices readily.

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TITAN BRONZE WELDING ALLOYS

Recent Patents

Welding Flux

2,139,522. Thomas C. R. Shepherd, Hale Barns, England, assigned to General Electric Co., New York. Filed Sept. 1, 1937. Issued Dec. 6, 1938. A flux for use in arc welding including 5 to 20% by weight of an alloy of magnesium associated with nickel and a carbonaceous substance, which in the presence of the welding arc, produces a shielding atmosphere. The alloy is essentially composed of 10% magnesium and about 90% nickel.

Plating Metal Sheets

2,138,982. Ulrich Raydt, Osnabruck, Germany. Filed Dec. 15, 1936. Issued Dec. 6, 1938. A method of plating a sheet of one metal with a sheet of another metal having a different welding temperature from the first metal, which involves heating each of the sheets in a non-oxidizing atmosphere to above the temperatures of rapid oxidation of the metals, to substantially the temperatures most favorable for welding the sheets, then pressing the sheets together while they are maintained at the welding temperature, while protecting the sheets against oxidation during these operations. The process produces an integral union of the metal sheets by welding without interference of oxidation scale.

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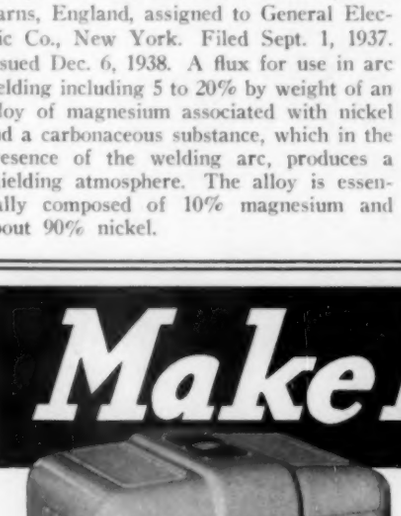

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UL Marquette A.C. Arc Welders are listed by Underwriters' Laboratories, Inc.

For complete information write:

MARQUETTE MANUFACTURING CO., INC.
MINNEAPOLIS, MINNESOTA

Welding Strip End to End

2,143,969. Florence C. Biggert, Jr., Crafton, Pa., assigned to United Engineering & Foundry Co., Pittsburgh, Pa. Filed June 29, 1937. Issued Jan. 17, 1939. A method of joining metal strip end to end, which comprises clamping the ends of the strips to be joined together in aligned relation, then positioning the strip ends in abutting relation for welding. The ends are progressively welded by simultaneously welding from both edges of the strip in toward the center. One welding operation is stopped before the center is reached, and the other welding operation is continued past the center of the strips until the weld is complete.

» «

Electrode Alloy

2,142,671. Franz R. Hensel and Earl I. Larsen, Indianapolis, Ind., assigned to P. R. Mallory & Co., Inc., Indianapolis, Ind. Filed Nov. 9, 1936. Issued Jan. 3, 1939. An alloy is disclosed which is suitable for pressure-exerting welding electrodes. The alloy has a high hardness and electrical conductivity. This results in greater freedom from mushrooming in service. The electrodes made from this material are well adapted for the welding of terne and tin plate. The composition contains about .05 to 5% cobalt, .01 to 2% phosphorus, .01 to 2% beryllium and the remainder is substantially copper.

» «

Copper-Brass Alloy

2,142,672. Franz R. Hensel and Earl I. Larsen, Indianapolis, Ind., assigned to P. R. Mallory & Co., Inc., Indianapolis, Ind. Filed Nov. 9, 1936. Issued Jan. 3, 1939. This patent, like the preceding one, is concerned with an alloy suitable for hard electrodes. The alloy contains about .05 to 5% cobalt, .01 to 2% phosphorus, .01 to 1% silicon and the remainder substantially all copper.

» «

Electrode Weldrod

2,133,970. Magnus Christensen and others, Barberton, Ohio, assigned to The Babcock & Wilcox Co., Bayonne, N. J. Filed July 2, 1930. Issued Oct. 25, 1938. A weldrod is provided having a sheath or coating of flux material, portions of the coating having been removed to provide spaced bare zones. These zones are for the purpose of permitting electrode gripping jaws and contact elements of a weldrod feeding device to move the rod and to make electrical contact with the rod core. A second patent by the same inventors issued as 2,133,971, covers the apparatus for feeding the weldrod. In that apparatus the contact shoes are carried on a moving conveyor. The shoes engage the movable electrode, while an electrical contact member is positioned to contact the shoe and supply current to the electrode.

» «

Welding Rod

2,142,673. Franz R. Hensel and Earl I. Larsen, Indianapolis, Ind., assigned to P. R. Mallory & Co., Inc., Indianapolis, Ind. Filed Sept. 16, 1937. Issued Jan. 3, 1939. The inventor sought to obtain a welding rod having excellent flowing characteristics and at the same time one which produces strong and hard joints. The material is particularly suited for building up worn surfaces of flash welding dies, or resistance welding dies in

general. The rod has utility wherever a copper alloy is joined to another copper alloy, or where a copper alloy is joined to a ferrous or to a non-ferrous alloy. The rod consists of copper with cadmium, nickel and/or cobalt silicide, and phosphorus in approximately the following proportions: cadmium 0.05 to 5%, nickel and/or cobalt silicide .1 to 10%, phosphorus 0.05 to 2%.

» «

To Test Quality of Welds

2,142,619. David Sciaky, Paris, France. Filed June 21, 1934. Issued Jan. 3, 1939. In all welding jobs the importance of testing the quality of work is recognized. Particularly in spot welding is such testing important. However, spot welding is difficult to check because of the completely automatic operation of the machine. While several methods of testing are known, including testing by magnetic fields, x-rays, and by mechanical tests, several limitations restrict these methods in their applications. Thus mechanical tests may fatigue the weld. Other tests require laboratory equipment. The invention employs an electric current flowing transversely through the welded pieces. A study of potential distribution in the metal gives a means of checking the value of the weld. The method consists in measuring the difference in potential produced between points located on the work.

» «

Blowpipe Igniting Apparatus

2,144,238. Lloyd W. Young, Elizabeth, N. J., assigned to Union Carbide and Carbon Corp., New York City. Filed Oct. 19, 1934. Issued Jan. 17, 1939. To avoid transformer or battery damage which may be occasioned by prolonged contact of a blowpipe tip and the work while striking an ignition spark, the inventor provides a blowpipe in which the electrical circuit is closed only when needed for ignition and is broken at all other times. The gas control lever of the blowpipe carries a push switch having one side electrically connected to the blowpipe and the other side connected to a conductor insulated from the blowpipe. Operation of the gas control lever automatically operates the push switch.

» «

Welding Chain Links

2,144,319. Edward W. Taylor, Hammond, Ind., assigned to S. G. Taylor Chain Co., Hammond, Ind. Filed Mar. 26, 1938. Issued Jan. 17, 1939. An electrical method for welding chain from a number of single lengths of unwelded link stock is described. Ends of the stock are aligned in butt relation and then welded electrically. The patent process appears to avoid many handling operations normally employed in chain welding.

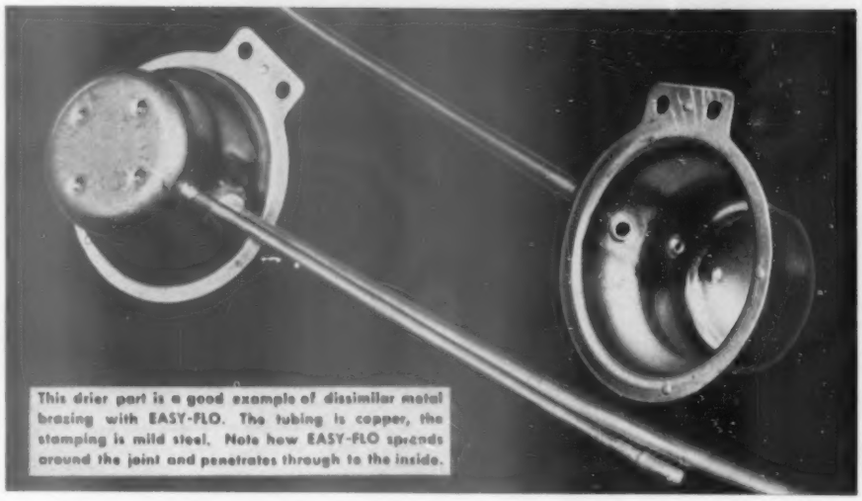
» «

Multi-Layer Welding

2,141,021. Robert M. Rooke, Jersey City, N. J., and Frederick C. Saacke, New York, N. Y., assigned to Air Reduction Co., Inc., New York, N. Y. Filed Dec. 9, 1936. Issued Dec. 20, 1938. Whereas it has been the practice in the past in welding heavy metal parts with an oxy-fuel gas flame to fill the joint with a short length layer of filling metal, the inventor of this patent provides the use

FOR BRAZING DISSIMILAR METALS YOU OUGHT TO TRY EASY-FLO

(U.S. Patent 1899701)



This drier part is a good example of dissimilar metal brazing with EASY-FLO. The tubing is copper, the stamping is mild steel. Note how EASY-FLO spreads around the joint and penetrates through to the inside.

EASY-FLO makes a simple operation of it. It joins dissimilar ferrous metals, dissimilar non-ferrous metals, or ferrous to non-ferrous metals — and at a surprisingly low cost.

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of relatively long fills. Short fills have been employed, since the metal cools rapidly and does not permit a succeeding covering layer of filling material to fuse properly with the lower layer. The patent process, however, permits the lower layer to cool, and after the succeeding layer has been laid, a reheating step is used to remelt slightly the lower layer to permit fusion of both layers. Moreover, the reheating improves the quality of the weld. By this method fills may be made from 2 to 12 in. in. length. The number of layers depends upon thickness of the work. For ½ in. metal two layers are sufficient. Stock ¾ in. thick is best welded with three layers.

» «

AUTOMATIC SPEED CONTROL

2,139,931. ALVIN F. BRUNKOW, Alma, Wis. This patent describes a speed control device for engine-driven arc welders. With this device the welding machine may run at a low idling speed of 400 r.p.m., or even lower, when the operator is not welding (while preparing welds, peening, arranging work, cleaning, changing electrodes, etc.). When the operator brings the electrode in contact with the work, the engine or machine jumps up to operating speed. When the arc is ruptured, the machine automatically drops to the adjusted idling speed.

The idling speed can be adjusted to any desired value up to the welding speed by means of a hand screw, without interfering or changing the operating or welding speed. A timing device is also incorporated, whereby the operator may regulate the rate of speed change from welding speed down to idling speed. This device is used in connection with the usual types of governors. Savings in fuel up to about 50 per cent are claimed, depending on welding conditions. It is further claimed that this device will save considerable wear and tear on the machine.

HIGH POWER FACTOR TRANSFORMER

2,136,863. FREDERICK C. OWEN, Fayetteville, N. C. Filed Oct. 9, 1934. Issued Nov. 15, 1938. Purpose of this invention is to provide a transformer in which the disadvantages, due to its normally low power factor are overcome by equipping it with a reactance of a character to materially improve power factor; to provide a construction in which the reactance is cut into and out of circuit, so that its beneficial effects may be had during load periods in the transformer, without disadvantages of the absorption of energy from the line during periods of idleness. The inventor provides a construction in which operation of cutting the reactance into and out of circuit is wholly automatic, but dependent entirely on presence of a load in the secondary.

The combination embraces a transformer, having a normally low power factor, a condensive reactance, an electrically-operated switch for connecting the reactance in one of the circuits of the transformer, and a coil for generating the switch-actuating current.

Trade Literature

WELDING OF WROUGHT IRON—A. M. Byers Co., Pittsburgh, Pa., has just completed a profusely illustrated bulletin giving complete data on welding procedure for wrought iron.

» «

SMOOTH-ON CEMENTS — This is a small pocket size booklet, 40 pages, describing applications of Smooth-On cements for finishing welds, filling in surface roughness, sealing surface cracks, pits, etc. This product is sold in powder form and is used by mixing with water, and is applied in a manner similar to putty. The cement hardens and adheres tightly, it is stated. Booklet can be obtained by writing to Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City, N. J.

» «

"ENGINEERING PROPERTIES OF NICKEL"—This is the title of technical bulletin T-15 just issued by the Development and Research Division of International Nickel Co., Inc., 67 Wall St., New York City. This new bulletin contains tabulated data on the mechanical properties and physical constants of nickel. Corrosion-resistant properties of nickel are summarized for a wide variety of exposure conditions. Proper procedures are included for hot and cold working, annealing, machining, welding, brazing and pickling.

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U. S. Patents 1,876,738 1,947,167 and 2,021,945

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